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LAWRENCE K. LUNT AND AUSTEN FOX RIGGS

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H. DICKINSON

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ARCHIVES OF OPHTHALMOLOGY.

NEUROTIC DISTURBANCES OF EYE FUNCTION.

By Dr. LAWRENCE K. LUNT and Dr. AUSTEN FOX RIGGS,
Stockbridge, Massachusetts.

I. INTRODUCTION.

THE reason for presenting this paper is the request of a distinguished ophthalmologist for information in regard to the treatment of a certain type of case not unfamiliar in his specialty; and further, the observation of another that so many cases of slight refractive error with marked symptoms do not get the expected benefit from glasses. Therefore the object of this presentation is the consideration of a few cases where pain or other symptoms are referred to the eyes, but in which no organic condition can be found to account for the extent of the discomfort experienced.

It is presumed that any incapacitating ocular discomfort which persists over a period of many weeks without discoverable cause, and remaining unbenefited, or insufficiently relieved by appropriate expert treatment, has a large neurotic element in its causation; that it is therefore largely, if not entirely, functional in nature, and that the treatment requires more than mechanical correction by glasses. But before presenting cases typical of such a condition it is essential to consider the mechanisms that make this possible. As there is no organic disturbance it is evident that the malfunction must be of the nervous system. What, briefly, is the nervous sys-

tem of the so-called "normal" man, and how can it be so disturbed functionally as to give rise to distinctly handicapping conditions? And finally what can be done to relieve such situations?

II. PSYCHOLOGY.

Man is a unit made up of many different parts all welded together and coördinated. The "physical" part consists of the bones, muscles, integument and the various systems specialized for individual purposes, i.e.: the digestion, circulation, respiration, etc. The system whose function is to coördinate these other systems and make the whole a unit, is, of course, the nervous system. It effects this purpose by its peculiar ability to receive messages and to act on these messages so as to make a reasonably satisfactory adjustment to the constant changes going on within the body and in its environment. The reception of many different kinds of stimuli and the transference of the impulses that are set in action, to the central nervous system is made possible by the high degree of specialization in the sensory end-organs, and the connection of these end-organs with the central nervous system by means of the afferent or sensory nerves. Impulses are constantly streaming in over the several sensory channels, impulses that tend to give rise to visual, auditory, olfactory, gustatory, tactual, thermic and somatic sensations. All of these sensations are capable of reaching, but do not necessarily always reach, the higher levels of the central nervous system, the "aware consciousness." There is a more or less automatic selection from among the sensations presenting themselves, and this selection is effected by the attention. The sensations that succeed in reaching the aware consciousness are those that have sufficient value, either because of their innate importance, such as the pain from a cinder in the eye, or because the will chooses to place importance on them, such as observing attentively the afferent visual impressions from the printed page. Because the awareness is concentrated upon any specific afferent stream, does not mean that the other afferent channels are closed. They may be, as far as attentive selection is concerned, as when the attention is focused on the patient's

story and disregards the many noises that penetrate to the office from the city street. But it not infrequently happens that the attention registers an impression not pertinent to the situation and so quickly turns back to the business in hand, that we wonder where or when we registered that particular impression. The sensations that actually fail to register, though they are capable of doing so, do not, because of their failure to impress our attention with their importance —that is they do not cross the threshold into the aware consciousness. Should we voluntarily turn our attention to them, or should they become more insistent than those upon which our attention is centered, they cross the threshold, and for the time being occupy the attention. It is obvious that the attention cannot be occupied with more than one thing at a time, and therefore it ordinarily disregards what is not useful to the situation in hand. Given an absorbing object, we are capable of disregarding sensations that are even innately important, as when we hold ourselves at work in spite of the discomforts of a headache or a "cold."

There is another type of afferent impulse that rarely reaches our conscious field, namely the splanchnic sensations, those that travel over the afferent channels of the sympathetic nervous system. This system, it is needless to say, is directly connected with the central nervous system, but its afferent impulses ordinarily stay below the level of consciousness. But when they do rise to consciousness, they do so either as general "feelings," such as the feelings of a full bladder and the relief experienced after evacuation, or when excessive, as actual pain. It is conceivable and not improbable that the sensations that defy description, vague, illy-defined sensations so frequently complained of, have their origin in this splanchnic sensory division of the nervous system. And it is not unlikely that many unusual ocular sensations can be explained in this way.

Presumably in the perfectly normal body under perfectly normal conditions there are no untoward sensations that knock at the door of awareness but as this Utopian dream rarely if ever exists, it is a matter of almost universal experience to have, at some time, some persistent sensory demand. In the average individual, this demand is given appropriate care and

then ceases and is forgotten, relegated to the sub-consciousness. But such satisfactory, "normal" adaptation to sensory disturbances is not always made. The unpleasant sensations continue in spite of there being no adequate cause found on the most careful and scientific search by experts of unquestionable ability.

III. HYPERSENSITIVENESS.

Why should some individuals fail to make reasonably satisfactory adaptations to the unpleasant where others, under similar circumstances, succeed? Briefly, because these individuals mismanage their normal sensitiveness and thus make it over-sensitiveness, which expresses itself specifically in maladaptation to certain unpleasant sensations, feelings or conditions. By "sensitiveness" we mean that normal inborn quality, existing in probably a very large proportion of individuals and in a well-balanced manner, which causes one to react sharply to pleasant and unpleasant contacts, but which tends, when not intelligently evaluated, to make one over-react to these factors. It has been said that the best work in the world is done by sensitive individuals, and this is probably true. Hence sensitiveness is an asset in our equipment and over-sensitiveness obviously a liability. The over-sensitive individual exaggerates the value of some or even all of the sensations arising from inward physical conditions or outward contacts, thus leading to an unbalanced and therefore an inefficient type of behavior. The over-sensitiveness, as already indicated, generally becomes specifically attached to the sensations arising from some particular function, and is apt to specialize in these sensations. The over-sensitization has, as a natural accompaniment, an over-emotional valuation of the specific unpleasantness, and any other disturbing elements that may arise, thus creating a vicious circle, over-sensitiveness chasing over-emotionalism around and around, while over-emotionalism chases over-sensitiveness.

It must be remembered that all of this development of malfunction takes place in an intrinsically normal individual; that it does not require a diseased body or mind in which to grow, and therefore that it is essentially an inefficiency in the

management of a normal equipment, primarily because of misunderstanding or ignorance,—only rarely as the result of difficulties in the environment, and still more rarely, if ever, because of wilfully wanting to be sick. Furthermore, it is important to realize that the specific type of disturbance, set forth in this paper, is only one manifestation of a condition which can express itself through any of the other bodily functions. But it is apt to be overlooked in this special field because of the high degree of specialization to which Ophthalmology has been brought. The surgeon, internist, and the specialist in other fields, as well as the ophthalmologist, is familiar with the case where a specialized or generalized oversensitiveness has been developed.

IV. HYPERSENSITIVE EYES.

In the field of Ophthalmology, the over-sensitiveness presents itself as discomfort or pain in or around the eye itself, or in other localities, the source being considered the eyes. The sensations complained of are varied, from frank ocular pain, blurring of vision, "tiredness," "weakness," or "heaviness" in the eyes, to all kinds of headache, and even mental confusion, and epigastric distress. There may not be sufficient deviation from the normal to justify even the simplest glasses, or there may be some slight defect in the lens or a minor muscular imbalance. Whatever the condition, the extent of the discomfort is far beyond what could be reasonably expected, and in despair a diagnosis of "congenital weakness of the eyes" is made, or else the less tolerant conclusion that the patient is a "crank." Undoubtedly there are cranks and congenitally weak eyes; but before such judgments are made, the personality of the patient and his method of reacting to his bodily sensations and to his environment should be studied.

Let us consider some cases of neurotic individuals where the outstanding feature was disturbance in ocular function. All of these individuals had become specialists in selecting the sensations arising in or around their eyes, till these sensations, from being either of normal or very slightly abnormal quality, had assumed an importance well beyond their true value, up to the point of incapacitation. Instead of the sensations being

valued correctly and disregarded, as is done by the average, they are exaggerated by being too constantly and fearfully under the attention.

V. ILLUSTRATIVE CASES.

Take for example the case of an intelligent woman of fifty, married for twenty-three years, whose grandfather had transmitted to his three granddaughters "very poor eyes." As a child she was "not very strong," and though there were no definite illnesses or apparent reason, she always saved herself and did not do as much as the other children, from the fear of possible injury to her health. Being of a rather timid type she avoided meeting strangers, and consequently did not make friends easily. But she was essentially of a friendly disposition and kept the friends that she did make. Thus early in life she began indulging her desire for self-protection and tended to an introversion of attention, and thereby an exaggeration of the emotions and sensations found within herself. She was happily married but suffered great disappointment because a pelvic condition, unremedied by operations twenty and eighteen years ago, prevented her having children,—a disappointment that frustrated her naturally strong maternal instinct, and to which she never completely adjusted herself.

A husband of none too robust and somewhat neurotic constitution, necessitated various moves,—to Florida, Oregon and South again,—each time with considerable apprehensive investigation as to the climatic effects on their health. Eight years ago an attack of typhoid served to concentrate an already too neurasthenic attention on various bodily functions and the sensations arising therefrom, especially the eyes and their sensations. Thus began the extreme condition of specific over-sensitiveness in which she is now found. Sensitive to her eyes because of family tradition and a slight insufficiency of convergence, she "strained" them during convalescence because her bed faced a window! A photophobia and continued ocular pain, said to be intense, developed and prevented all use of the eyes involving the slightest concentration of vision. This handicapped condition continued with negligible improvement in spite of the assurance of two of the country's

best ophthalmologists that it was not organic, and the prescribing of appropriate glasses to correct the slight abnormality. On admission she was able to use her eyes on reading and sewing for a total of only eight minutes a day, but with continued pain. She presented the picture of a person sadly resigned to bad eyes and impending blindness, and had even mastered Braille against the day when she could no longer see. She had a genuine desire to get well, and by re-education in which she fully coöperated, she had at the end of eight weeks attained to the use of her eyes in the concentrated efforts of reading and weaving, without discomfort, for a total of three and a half hours a day. This did not include the still further use with more or less concentration on odd jobs of sewing, doing picture puzzles, etc. In short her eyes were restored to normal usefulness.

Certain points of interest are worth reviewing. There was an unmistakable and rather striking family tradition of "bad eyes." There was a self-conscious shyness causing the development of a hypersensitiveness, becoming specific for unpleasant bodily sensations, particularly from the eyes. There was the aggravating source of contagion from a neurasthenic husband and the great disappointment of not having children. A serious illness (typhoid) served to fix the attention on self in terms of malfunction. And finally an intelligent coöperation in re-education resulted in complete restoration to full and comfortable function which, according to a report a year and a half later, has been fully maintained.

The next case is of a single man of twenty-five, of excellent inheritance both mentally and physically and a past history of no medical interest, except that he had worn glasses from boyhood. He graduated from school and college successfully and with many friends, and enlisted for war service. His two years in France were much to his distaste and a source of real disappointment, because he had to serve as instructor in an officers' training school while the unit with which he had gone overseas went into action. After being mustered out of service he had a few unpleasant months marked by continued irritating emotional stimulation from domestic problems. He then entered the Law School, and after passing his first year without trouble, went immediately into an office where he

worked nine hours a day and spent his evenings trying to learn more of his profession. After a few weeks of this he began to get "dopey" and sought the relief of an oculist. It is interesting that his first thought was that his eyes were the cause of his trouble. The suggestive effect of a change of glasses proved a temporary relief, but as the unpleasant sensations of tightness around his head, dizziness and faintness returned and increased, he stopped work. Rest in bed, change of climate and outdoor activity, with no use of his eyes, so far restored him that in three months' time he started the second year of his Law course. He only lasted a month in spite of honest effort, and then gave up almost in despair.

As in the first case, so this one was put on a gradually increasing schedule of eye training and by the end of eight weeks he was reading four one-hour periods with two hours between each period, with a certain amount of discomfort, but not enough to prevent progression, so that two weeks later only five minutes separated the reading periods. A report two years later states that he is about to complete his Law studies and plans to enter an office. An incident worthy of note, showing the force of suggestibility in a traditional idea, occurred midway in his training. He reported that he had been very unwise and as a result his eyes were particularly uncomfortable again: he had read for ten minutes before breakfast. Upon inquiry it was found that he had been brought up with the idea that it was harmful to use one's eyes on an empty stomach! An explanation that this notion was without foundation—a mere old wives' tale—and prescribing fifteen minutes' reading before breakfast as part of his routine, immediately dispelled this symptom.

Here we have the picture of a young, active and intelligent man in favorable circumstances without sufficient organic reason to account for his incapacity, entirely unable to cope with life as he had planned it for himself, bewildered by troublesome sensations. What factors of interest stand out in this case? First a definite sensitiveness, not grossly noticeable in social shyness, but in more subtle ways, as in an overcompensation evinced in a rather humorous self-depreciation, and by an easily disturbed facial vaso-motor stability. From the family it was learned that he was the favorite especially of his mother,

although he had an older brother and a younger sister. That his eyes had served as a focus for his attention was made evident from the fact that for years the consultation and oversight of a far-famed ophthalmologist in a distant city were thought necessary, although equally skilled attention could have been had close at hand. To this already overbalanced situation are added war service, with the frustration and disappointment of getting only hard trying work and no glory, emotional worry at a time when he most needed recreation, and then many months of hard intellectual work where there was a premium on sound eyes. Then in all probability the contact with the realities of his profession in the practical work of an office gave him an exaggerated feeling of inadequacy on the basis of his too ready self-depreciation, and he became self-conscious in terms of ocular sensations, magnifying these until they instituted a functional illness.

The third case is a young unmarried woman of twenty-five, also with a negative family history. At twelve years of age she had measles with the unpleasant involvement of the eyes that not infrequently accompanies this exanthem; and two years later, during her High School course, she had occasional headaches with dizziness which she attributed to her eyes. All her six brothers and her older sister were earning their own living and she felt it incumbent upon her to do likewise. Talented musically, she spent two years at a conservatory, but gave it up, because an overweening shyness in performance made her fear failure. On the occasion of giving up this pursuit she had a few weeks of mild depression dignified by her doctor as a "nervous breakdown," from which she made a good recovery. Thereupon she entered a business school, graduated and obtained a good clerical job; but in her spare time she worked at her music. At about this time she lost in one year her fiancé in the war, her mother, and then her father. A few months after the father's death she had "influenza" lightly. Two and a half months later her eyes began to feel strained and she took three weeks off. Following this she stuck at her job with difficulty for two months and then gave it up because of her eyes. She found that if she did not use her eyes at all she felt well, but the slightest use brought on ocular discomfort, a sense of pressure in the head and at times

even dizziness. These sensations "got on her nerves," and it was with great difficulty that she could even act as assistant to her sister and give three music lessons a week. The idea that she could not make her living because of the supposed handicap, gained ground, and amounted to a cause of a fairly serious depression, with a continuous feeling of "strain" in her eyes. A competent eye examination revealed nothing out of the ordinary and the opinion submitted was that the eyes could not possibly account for the condition. A general physical examination showed a normal body with an unstable vaso-motor system as evinced by cold moist hands and feet.

More detailed examination of her history brought out the facts that from early childhood she had been considered as having exceptional musical talent, and great things were expected of her by her family and herself. But she always lacked confidence at the crucial moments and therefore failed to realize the great expectation. However, she never gave up her music, her first love, and her desire to excel therein. While studying for and working at her clerical job, she was working on music and was continuously dissatisfied at not really fulfilling her ambitions, and at the same time she suffered a series of naturally severe emotional shocks. This emotional stimulation undoubtedly served to intensify the dissatisfaction which then assumed such proportions that she finally found escape by the route of functional disturbance of the organs upon which she had put the most attention in the past. She then gave up her work, and became, to all intents and purposes, an invalid. The usual course of intensive and carefully supervised training did not happen to be possible in this case, but sufficient re-education was absorbed and schedule maintained, along with a re-establishment of effort towards the normal and well founded ambition, to effect increase in self-confidence, and restoration to reasonable usefulness. Learning how it was possible and not unusual to get into such a sensory mix up, she found that she could disregard her bothersome sensations and not use them as means of escaping from possibilities of failure. Here, too, we find a basic sensitiveness plainly seen in her shyness, unwillingness to make friends, and a self-depreciatory trend,—a sensitiveness that easily became over-emphasized and specific to the eye sensations. Being of a highly self-

protective type, she attempted to make an escape from a course that was rather intensely disliked, and yet she could not make a satisfactory adjustment to the more to be desired course, so she takes the obvious road of escape on a basis of supposed illness,—a method that is doomed to failure. A point of interest in this case is the different social level of this individual. It illustrates the fact that "neurasthenia," or whatever one wishes to name the functional nervous disorders, is not limited to the "upper classes," where there may be no necessity for making one's living. It cannot be emphasized too strongly, popular ideas to the contrary notwithstanding, that these disorders are not specific to any one class or social level. They are human disorders, irrespective of the occupation or bank account of the victim. The first two cases cited were in a financial position to have at least been assured of continued existence in spite of lack of gainful effort. But this fact in no way contributed to their breakdown. In the last case, however, work for a livelihood was a necessity, recognized and accepted—but neither was it a factor in the ætiology of her mal-adaptation.

VI. RECAPITULATION OF CASES.

Although widely different as individuals these cases show certain features in common. In the first place we find in each one an innate quality of sensitiveness. We can take it for granted with reasonable certainty, that in childhood each one was subjected to the adverse effect of an over-apprehensive regard for health and thus early in life became predisposed to future misinterpretation of practically normal sensations. In each there was a disturbing emotional element arising from circumstances, which, although partially accepted intellectually, were still persistently over-emphasized, and thus contributed to the breakdown. A disappointment or frustration of any intense natural desire, if not completely accepted and discounted, tends to persist as an underlying emotional imbalance, which makes fertile soil for the germination of neurotic seed. Frequently, but by no means of necessity, some physical illness or prolonged strain helps to upset the equilibrium, and constitutes the fabled straw that "breaks

the camel's back," and therefore it generally gets the blame for the break. In the first case typhoid fever, in the second the physical and emotional stress and strain of war service, and in the third "influenza," enter the picture in this rôle. Finally each individual possessed at least fairly well-trained intelligence. Here again we can advance evidence to upset the much too common belief that anyone "giving into nerves" is a "fool."

VII. THERAPY.

It is evident that this type of case requires more than the fitting of glasses. Where Ophthalmology leaves off, there Psychotherapy begins. In so brief a survey psychotherapeutic "re-education" cannot be dealt with in much detail, as each individual case must be approached and treated in the way best suited to his type of intelligence and personality; but the general principles can be briefly stated. In the first place, patients of this class are most effectively treated through their intelligence. The old style of therapy, that the patient must be kept in black ignorance of the nature of his malady and the medication used, cannot be tolerated here. Simple reassurance sometimes helps for a short time, but not for long. Neither will brushing aside the symptoms as "imaginary" be of much avail; in fact this often does a great deal of harm, as the average person knows what he feels, and if his doctor says it is imaginary the doctor is apt to be justly branded as ignorant. Most people who have to, or do use their eyes concentratedly, have at least enough intelligence to resent being told that their genuinely troublesome sensations do not exist. If they feel them, they are real regardless of whether there is physical cause or not, and they must be treated as real.

In the second place the physician must keep an open and tolerant mind. From his suspicion or knowledge, that the symptoms are not of organic origin, is apt to spring intolerance to the patient who presents this condition. When this occurs, the effectiveness of the doctor is almost sure to cease, for he then approaches the situation prejudiced against it, and therefore the most intelligent treatment is impossible. With a tolerant attitude then, the explanation begins, and it must be

as painstaking and patient as the need requires. On a firm scientific basis of common-sense mental mechanics, it is shown how such symptoms in the intrinsically normal individual can arise and persist without a sufficient organic basis. With this general knowledge the patient begins to see himself as not so different from other people, and finds out where he has made his mistakes in management of self; he learns to think of himself in terms of normal instead of abnormal function. This effect is not gained by "suggestion," the uncritical acceptance of the propositions, but by the use of intelligence, the acceptance of the propositions by the critical faculties. One point of great value in the specific psychotherapy of these "eye cases," is aimed at the habit that they are apt to have formed, of too detailed inspection of the object of ocular attention. They seem to almost try to spell out each word with a concentration that must of itself be fatiguing. They revert to the method of the child just learning to read, but they lack the freedom of responsibility of the child, and instead of the spasmodic effort of the latter, they attempt to hold the delicate adjustments of the eyes to genuinely tiring concentration. Therefore these cases are retrained to "glance at the print,"—to get a bird's eye instead of attempting a microscopic view. It is believed that by reteaching this method, which is automatically used by most people, a certain proportion of the prescribing of glasses for unimportant defects can be done away with. Finally there is careful oversight of the physical activities as well as the training of the supposedly handicapped function, so that the gains may become real and permanent.

It is obvious that it is not possible for those who are highly specialized in one field of medicine to go into another special field. The ophthalmologist has not the time, desire or training to attempt psycho-therapeutics, nor is it expected of him by his professional colleagues or his patients; but he can be of immense value in appropriate cases by the manner of his approach and treatment. By early recognition of the type of individual who tends to develop neurotic interest in his eyes, he can by common-sense advice often prevent serious functional incapacity. By recognizing the fact that "nervousness" is nearly always the cause of functional eye difficulties rather than vice versa, he can by adequate and intelligently explained

reassurance prevent the formation or continuance of an unnecessary handicap. And finally, by being willing to admit frankly and to take the trouble to explain why glasses are not necessary in certain cases, he will help to decrease the all too widespread dependence on artificial props, and thereby help to keep many from the ranks of the neurotically handicapped, making them more self-sufficient and more useful citizens.

THE EMBRYOLOGY OF TENON'S CAPSULE.

By Dr. ISADORE GOLDSTEIN, New York.

(With four illustrations on Text-Plate XXIX.)

From the Embryological Institute of Vienna University.

ABOUT the development of Tenon's capsule, nothing is fully known. At least I could not find any information on this subject either in ophthalmological or embryological literature. To fill this gap in our knowledge, I examined serial sections of human embryos contained in the institute of embryology of the University of Vienna and have discovered some facts which will be of interest.

It is understood, of course, that the results of this research are in no sense exhaustive. For a complete solution of such questions serial sections of very many stages of development are necessary.

My material was insufficient for this since I have had to confine myself to the embryological material that was obtainable in this one institute. Still, I believe that, for the matter at hand, the following are decidedly important facts which should excite further investigation.

Serial sections of thirteen embryos were examined, and the Scheitel-Steiss length of the largest specimen came to fourteen centimeters.

The first appearance of Tenon's capsule I shall mark with a string of cells, visible in Figure 1 and marked C. T. The cut pictured here comes from a human embryo of twelve millimeters extreme length. It meets the fetal ocular fissure, through which may be seen the mesodermal string of cells covering the hyaloid artery progressing to the posterior surface of lens. The ocular cup therefore consists of a dorsal and a

ventral division, which are apparently connected. In accord with the tender age of the embryo, the retina has not yet separated into single layers; the lens is in the stage of the lens-vesicle. The anterior chamber and eyelids are not yet developed. At a short distance under the ocular cup a mass of cells can be seen arising from the rest of the embryonic connective tissue (mesoderm, mesenchyme) which are very closely pressed together and it can also be seen that many of them possess nuclei more distinctly colored and rounder than the nuclei of the other mesodermal cells. This mass of cells advances, under the inferior rectus muscle, to that place which corresponds to the future fornix inferior, a circumstance which, as we shall see, is important for the significance of this mass of cells as the first foundation or fundament of the capsule of Tenon.

This formation is evident in Figure 1 in the immediately under and forward part of the future Tenon's capsule. In this stage of development nothing is observed in the remaining parts. This foundation of the capsule of Tenon, as well as the connection with the fornix conjunctivæ, is quite plain in Figure 2.

The serial section in question comes from an embryo 15*mm* long. Here the differentiation of the retina into its individual layers has taken place. The lens fibers are formed and eyelids (P. s. and P. i.) are beginning to grow. The fornix superior is much deeper than the fornix inferior, and the epithelial beds of the future pars bulbi and pars conjunctivæ are readily seen. In the fornix superior the epithelial bed has already been partly separated by cleavage, while as yet it has not taken place in the fornix inferior. Around the eye-cup choroid and sclera are beginning to differentiate; eye muscles (rectus mediales, rectus inferioris, and obliquus inferioris) and also nerves here make their appearance. Deep branches of the motor oculi nerve are well developed. We now notice that the embryonic connective tissue around these muscles is more compact, and this forms a loose sheath for these muscles. This sheath appears in the under half of the section as entirely separate from its surroundings. It is composed of a firm mass of cells (C. T.) directing itself toward the fornix inferior, where it fuses partly with the tissues of the lower lid, the palpebral

ILLUSTRATING DR. ISADORE GOLDSTEIN'S ARTICLE ON "THE EMBRYOLOGY OF TENON'S CAPSULE."

1. Cut through a human em-
2mm extreme length, enlarged
es. C.T. Anlage of the capsule
on in its earliest development, re-
ted by elongated cells with deeply
g nuclei.

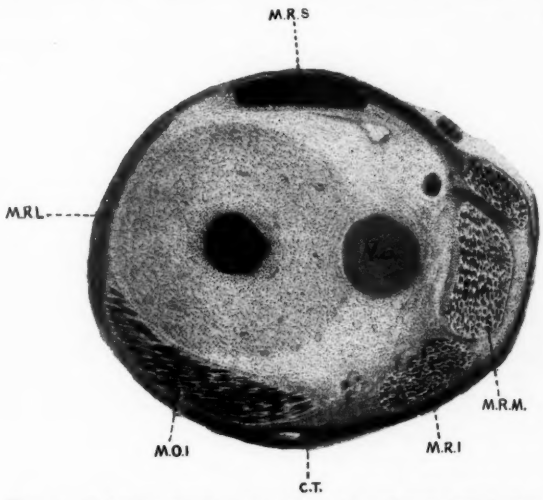
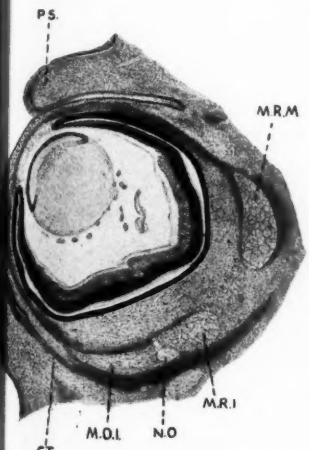


FIG. 4. Cut through a human embryo 6.4*cm* Scheitel-Steiss length enlarged 44 times.

M.r.s. Superior rectus muscle.
M.o.i. Inferior oblique muscle.
M.r.i. Inferior rectus muscle.
M.r.m. Internal rectus muscle.
N.o. Optic nerve.
M.r.l. External rectus muscle.
C.T. Capsule of Tenon quite thick, eventually forming Lockwood's ligament.



IG. 2. Cut through a human embryo
m extreme length, enlarged 44 times.
.s. Beginning of upper lid. M.o.i. In-
or oblique muscle.
.i. Beginning of lower lid. N.o. A
nch of the 3d nerve.
. T. Capsule of Tenon. M.r.i. In-
or rectus muscle.
I. r.m. Internal rectus muscle.

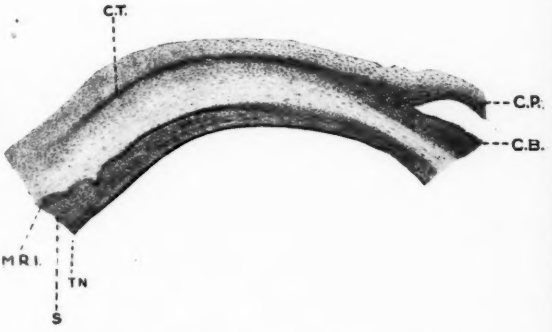


FIG. 3. Cut through a human embryo 9*cm* Scheitel-Steiss length enlarged 56 times.

C.T. Capsule of Tenon.
C.p. Extension of the capsule of Tenon into conjunctiva of lid.
C.b. Extension of capsule of Tenon into ocular conjuctiva.
S. Sclera.
T.n. Tapetum Nigrum.

conjunctivæ, and ends apparently in the attachment of the cornea. This distribution of the cells will be seen clearer in Figure 3, which is a high power drawing.

Figure 3 shows a part of the lower section of the bulb of an embryo 9*cm* Scheitel-Steiss length. Only the pigment epithelium (T. n.) is shown of the retina. Around this the choroid and sclera (s) are forming. The sclera lies on the tendon of the rectus inferior. Externally to the tendon of rectus inferior the embryonic connective tissue is very loosely arranged. This loose zone is surrounded by a thickly woven mass of cells, which represent the already known point of attachment of the capsule of Tenon. This mass of cells can be traced to the transition point of the conjunctivæ bulbi (C. b.). It can also be followed to the palpebral conjunctivæ (C. p.) with which it fuses. The part entering the conjunctivæ bulbi is wider, but becomes gradually thinner as it reaches the base of cornea. This cell-mass can be easily differentiated from other structures contained in the orbit by its histological characteristics. Its cells are long drawn out, spindle-formed, and lie in close contact. In form as well as in coloring capacity the nuclei differ from the others, i.e., they are more round and take the stain deeply. The transition of the cells into fibers is very clear at this stage of development.

The formation of Tenon's capsule proceeds quite rapidly, even before the stage of development used in Figure 3. It is already noticeable around the cone of the eye muscles developing there; this can also be noticed from similar sections. Figure 4 pictures such a section coming from an embryo 6.4*cm* Scheitel-Steiss length. The dark circle corresponds to the cut into the pigment epithelium of the retina, the tissues around it show the points of attachment of choroid and sclera. The circle lying far towards the inner side is the horizontal section through the optic nerve (N. o.). The horizontal sections of several eye muscles are seen here. (The external rectus muscle consists of several masses of separate fibers.) All around these muscle insertions an enveloping zone can be observed, which consists of cells closely packed and distinguishable from the others.

This covering zone is evidently the capsule of Tenon. At this stage the capsule of Tenon shows a more pronounced

development in the lower part than in the upper part. (See Figure 4.) The capsule is very thick especially where it goes over from the rectus inferior to the obliquus inferior (M. o. i.) corresponding to the future ligament of Lockwood. On the inner surface of the eye muscles, the capsule in this stage is less developed than on the outer surface.

The development of the space of Tenon begins somewhat later and in such a manner that the tissues around the capsule of Tenon are loosened, while the intervals between the single cells become larger and coalesce.

These observations though produced with the limited material at hand represents the first attempt made to describe the capsule of Tenon in its very early development.

I submit this report in the hope that it will stimulate further pursuit of this little known but none the less important subject.

I here wish to thank Prof. Dr. A. Fischel for the valuable assistance extended to me in collecting material for this research.

DISEASE OF THE OPTIC NERVE AND ITS RELATIONS TO THE POSTERIOR NASAL SINUSES. REPORT OF FOUR CASES SHOWING THE UNCERTAINTY OF THE DIAGNOSIS.[1]

By Dr. COLMAN W. CUTLER, New York.

AT a meeting of this Section in conjunction with the Laryngological Section, October 26, 1921, Dr. White, of Boston, read a paper on the accessory sinuses, and I had the privilege of describing the relations of the optic nerve to the sinuses, the methods of diagnosis, the indications for operation, and the danger incurred both in neglecting cases where vision was threatened by the inflamed sinus, as well as the risk of a too hasty operation with an incomplete diagnosis (1). Little, however, has been added to our knowledge of this subject since Van der Hoeve's excellent paper (2) in 1911 and his review of the subject in 1922, both in the Archives of Ophthalmology. Striking cases have been reported in which the diagnosis was promptly made, the operation successfully carried out, and the cure complete.

Perhaps enough has been said about the acute cases with an obvious connection between sinus and nerve, in which, with proper, discriminating care, a successful outcome may be expected. Undue emphasis on these fortunate and not infrequent cases may well lead to an optimism which would be misleading in the more difficult cases which it is our duty to consider. Less has been said of cases in which the diagnosis is difficult or impossible, and yet the appearance of retrobulbar neuritis with characteristic defects in the field, with diminishing

[1] Read before Section on Ophthalmology, New York Academy of Medicine, January 15, 1923.

vision, makes some attempt at relief very urgent. Such studies are needed. We may learn that a variety of conditions simulate canalicular neuritis very closely, and it is more important to report unsuccessful cases, and especially those in which the operation has met with unexpected or unusual difficulties, than to add to the large number diagnosed and relieved.

It would be well to consider whether we can classify the cases in which the nerve is affected in its short canalicular course. The peripapillary scotoma of Van der Hoeve has been considered a probable sign of disease in that region whether it was associated with a central or paracentral scotoma or not, but experience throws doubt on its infallibility. It is still fair to assume that inflammation of or pressure on the nerve in the narrow canal causes these symptoms in most cases and that the posterior ethmoid and sphenoid sinuses are the most frequent source of this subdivision of retrobulbar neuritis. That there may be other causes, however, the cases here cited will indicate.

Miss A. M. D., age 45, musician. Seen first January 20, 1921. Noticed a blur before the right eye three weeks ago. Headache not severe, variable, when tired. In November had had a severe neuralgia in right parietal region with vomiting, attributed to a bilious attack. No nasal symptoms, but in September and October had had a severe cold in the head. She had been treated by Dr. Coffin for a condition of the left ear. The sinuses were then thought to be normal. Vision: right eye $\frac{20}{60}$; left $\frac{20}{20}$. Pupils equal, react to light. Right, slight hippus, dilating after exposure to bright light. Both optic nerves, veins somewhat full. Right optic nerve slightly blurred upwards. The right field of vision was normal in its periphery with no central or paracentral scotoma; blind spot large. Left blind spot normal. Vision in the right eye fluctuated. In February it was $\frac{20}{30} - 2$: with $+ 1.50$ she read Jaeger 3 with difficulty. The left eye remained normal. During the winter of 1921 she had more or less cold in the head, and headache in the top of the head and through both eyes. Vision improved during the treatment of the nose by suction, to $\frac{20}{20}$, and as the rhinitis improved, the headache disappeared. There was no pain in the eyes or on pressure backwards or over the ethmoid. In March she had a severe headache in the top of the head and both eyes; vision failed slightly, although the blind spot was not as large and did not show the variations that had been so noticeable in January and February. In

May the vision in the right eye fell to $\frac{1}{10}$ and there was considerable blur, but no central or paracentral scotoma detected. The temporal half of the right nerve became pale. Arteries a little small, but the edges of the nerve remained sharp. There was considerable sensitiveness to light, but no disturbance of the light sense that could be made out. The right blind spot showed an interesting condition. It was large continuously and showed almost daily variations, with, at times, a paracentral scotoma, especially for red. Periphery of the fields remained normal. The failing vision, the variable blind spot, the slightly wider right pupil, and, towards the end of my observation, the pallor of the temporal half of the right nerve, were associated with a nasal condition sufficiently suggestive of sinusitis to justify the diagnosis of retrobulbar neuritis. A tentative exploration, after suction had been tried in vain, was made by Dr. Coffin, but drainage of the cells brought no relief. She passed into other hands after that and I have heard recently that she died a few weeks ago. The autopsy revealed an aneurism of the circle of Willis.

This history is interesting, as it gave several of the symptoms of a neuritis of the canalicular portion of the nerve, usually associated with disease of the posterior sinuses, and these symptoms were probably caused by pressure on the nerve at the chiasm in such a manner as not to affect the left nerve at all. It is of course possible that there was a retrobulbar neuritis arising from a sinusitis also, and the early improvement following Dr. Coffin's treatment added weight to this view. It is a great pity that the specimen could not have been obtained, as the mechanics of the pressure is obscure. It is possible, however, that pressure from behind can cause enlargement of the blind spot and simulate retrobulbar neuritis of canalicular origin and it is possible that intracranial pressure, without choked disk, may cause the same symptoms.

J. C., age 23. Seen first Sept. 28, 1922. Headache over both eyes for four months. Inability to do continued work. Patient had been a brilliant student at college, but on entering a professional school his former capacity for intensive work had failed rather suddenly. No apparent signs of disease or of toxæmia. His condition at that time did not justify hospital care, so no examination of spinal fluid was made, but blood Wassermann, urine, were negative. Habits good. General appearance that of a healthy man, but

showing a certain lassitude, with fatigue of eyes and inability to concentrate. No nasal history. A thorough rhinological examination by Dr. Bowers was negative. X-rays negative as regards sinuses and sella. Vision, R. and L., $\frac{20}{15}$, J. 1 at 14*cm*. Muscular balance normal, but with slight insufficiency of convergence. The lids seemed heavy as if both levators were weak, but no true ptosis. Pupils equal, react promptly. No history of diplopia. The optic nerves were congested, the right blurred upward and the left showing striation of nerve fibers at its lower edge. Fields of vision, normal periphery, although the upper limits have been slightly narrowed at times. Blind spots have been larger than normal, with considerable though variable enlargement for red and blue. At the last examination, Jan. 3rd, the heaviness of the lids was a little more marked and he stated that he had been sleepy, 10 to 12 hour sleep being necessary.

In view of these vague symptoms, it seems as if we had to do with an encephalitis lethargica of unusual duration. Dr. Samuel Lambert is inclined to this diagnosis. The enlarged blind spots, with the congested and slightly blurred nerves, may indicate a low grade of retrobulbar neuritis, which would add an interesting symptom to this perplexing disease, and would also add a condition to be considered in the diagnosis of the group that we are discussing.

Miss J. D., age 16. Feb. 14, 1922. A normal appearing girl, somewhat pale, with a neurotic heredity. She had been working at school rather harder than was her custom or choice and had been irregular in diet and was evidently disordered as to digestion as shown by the skin and tongue. After prolonged study for examination she complained that the eyes ached severely and this continued in spite of rest and atropin. There was no history of nasal symptoms; the X-rays of the head were normal. The eyeballs were quite tender to pressure.

Vision: R. E.: $-0.75 \bigcirc -1.$ axis $115 = \frac{20}{15}$; L. E.: $-0.75 \bigcirc -1.$ axis $35 = \frac{20}{15}$.

Fields will be considered later. Both nerves showed slight veiling of nerve fibers, although the edges were visible. Vessels slightly over-filled. Pupils normal. No muscular insufficiency. Injudicious hygiene at school and overwork may have been the exciting factors in this case. The predisposing factors are described by Dr. Charles Jack Hunt in the following statement:

"Miss D—— did not present evidence of bacterial intoxication. Foci are not demonstrable by clinical or cultural methods. This includes the respiratory, gastro-intestinal and urinary systems. The pelvis was not examined, but I have every reason to accept a negative history.

"The chief complaints (other than ocular) were fatigue, insomnia, anorexia and apprehension associated with school examinations.

"She had tonsillectomy and adenoidectomy during the year previous to this study. Following operation she lost 30 lbs. in weight. She now weighs 129 lbs.—a gain since last fall. Acne developed at 14 years (2 years ago) and is worse when at school and with menses. She fears examinations, is willful, 'suffers' with polyphagia, though the appetite is often capricious. It was customary to consume much fruit, chocolate bars and peanuts between meals while at school. The diet included meat twice each day with bacon, butter, creamed foods, eclairs, ice creams, etc. Satisfactory details otherwise were not obtainable.

"Thirteen days prior to first examination she was sent to the school infirmary with nervousness, nausea, vomiting and nostalgia. This was concurrent with the onset of pain 'about and in both eyes.' It is clear that the actual onset was *not abrupt* though the presenting symptoms (as stated) would indicate such an onset.

"Physical examination showed a well nourished, relatively tall girl with pallor of skin, bright red mucous membranes, redundance of nasal and oral lymphoid structure, papular acne vulgaris of face, neck and upper third of trunk; moist and cold hands and feet and mild acrocyanosis. Despite rather widened palpebral fissures and hyperæsthetic reaction to touch, the expression was dull and the attitude relaxed.

"The thyroid gland was visibly irregular in size, the right lobe larger than left, free from local masses, pulsation and tenderness.

"Examination of the lungs, pleuræ, mediastinum and pericardium was negative.

"The heart was normal in position and size. There was a considerable degree of myocardial irritability. Diffuse pulsation with vibration of pericardium was present at times, but adventitious sounds and thrills were not observed. The rhythm was regular, rate varying from 96 (recumbent) to 126 (standing). The blood pressure (patient recumbent with Hg method) varied from 140 S to 102 S and from 78 D to 60 D.

"The abdominal findings included a very sensitive transverse duodenum, tenderness of cecal and appendix regions, mobility of right kidney (as found in hypoasthenical types)

and an abnormally large amount of tympany of the gastro-duodenal and cecal regions. The sigmoid flexure was very spastic and somewhat tender. There was no clinical evidence of ulcer, appendicitis, cholecystitis or colitis.

"The nervous system was studied repeatedly. Progress toward recovery was rapid, hence notes only of the first examination are included in this report.

"The sensory system showed the most marked signs. Joint and muscle sense, sense of position and stereognostic sense were apparently normal. Symptoms and signs were absent in examination of the 1st, 7th, 8th, 9th, 11th and 12th cranial nerves. Examination of the 2nd, 3rd, 4th and 6th as previously noted. In the regions supplied by the 5th cranial and all spinal nerves, there was definitely marked deep pressure pain. Bilateral superficial algesia in the distribution of the 5th cranial nerve and of the abdomen and feet. Thermal sense was acute, especially for heat (50° C). Tactile sensation was not impaired.

"The tendon reflexes were brisk—equally so on both sides. Patellar and ankle clonus were absent. Cutaneous reflexes were exaggerated sufficiently to make examination difficult, but variations from normal reactions were not found. The organic reflex activity was not tested. However, a history of spincter dysfunction was not had.

"The gait was normal. The station was impaired, the body swaying posteriorly and to both sides but corrected by coördination tests. The latter were negative. There was a very rapid, fine and regular tremor of the extended hands and feet, attempts to study fatigueability (especially of reflexes) was not successful, mainly because of lack of coöperation. Occasionally a crossed reaction was obtained with patellar reflex.

"Examination of the motor system was negative by every method in use except instrumental measurements.

"*Urine examinations* showed high sp. gr. (1030) gradually falling to 1015; large amounts of acetone, aceto acetic acid, marked reaction for indoxyl sulphate tests, traces of albumin and sugar, recurring presence of casts and calcium oxalate crystals.

"Chemical examination of the blood showed:

		Normal
N. P. N.	42.3 *mgms*	30–35 *mgms*
Urea N.	21.1 "	12–18 "
Uric Ac. N.	7.6 "	3 "
Sugar	122.2 "	110 "
Cholesterol	218 "	150–180 "
$C O_2$	46.5%	53%

"*Diagnoses* of diffuse perineuritis and thyreotoxicosis were made. The painful bilateral cutaneous and deep hyperæsthesia, absence of areas of anæsthesia and of motor disturbances, and the presence of definite thyreotoxic signs led me to believe that a diagnosis of hysteria could not be made. That a ' neurosis ' was a basic factor in the clinical picture is, of course, obvious. It seemed wise to defer further study of the thyroid gland in order to correct the immediately acute pathology.

"In the absence of chemical poisons, bacterial intoxications, trauma and states of malnutrition, the only probable cause of perineuritis would seem to be found in disturbed metabolism. Of the last named, involvements of the nerve trunk are more commonly found in disturbances of fat metabolism (3), (4), (5), (6). Suboxidation of fats leads to the formation of ketone bodies, of which beta-hydroxybutyric acid, acetone, and aceto-acetic acid (diacetic acid) are present in excess and easily recoverable (7), (8), (9). Such a disturbance of metabolism is manifested in a reduced alkalinity (of the blood), that is, a reduction of the $C O_2$ combining power of the blood plasma, the presence of acetone and aceto-acetic acid in urine, acetone odor to the breath, changes in the respiratory quotient, and evidences of widespread toxæmia affecting, particularly, the function of the nervous system. All these and other confirmatory findings were present in the case of Miss D——, who showed definite evidences of a diffuse perineuritis. Such changes in the fundamental metabolic processes may be the single basis for the neural pathology and is, theoretically, a basis upon which bacterial intoxications become active."

The treatment was confined entirely to a very restricted dietary both as to quantity and simplicity, increased intake of alkalies, passive exercise, and improved elimination. In the course of about five weeks the very marked changes in the fields of vision entirely disappeared and the eyes became normal coincident with the improvement of her peripheral nerves. On March 20th vision was $\frac{10}{10}+$. Fields, periphery, blind spots normal. No fatigue after prolonged reading. No tenderness on pressure over eyes.

This case is especially interesting because there were no signs of focal or other infection and the only explanation (unless one attributes it to a pure hysteria, which seems highly improbable, as there were no other signs of such a neurosis) is the one offered by Dr. Hunt, of a metabolic poisoning, especially

as his treatment resulted in complete relief of the symptoms. I was tempted to urge an exploration of the sinuses in spite of no rhinologic symptoms, because of the marked changes in the visual field and the blurring of the disks, but Dr. Erskine's positive statement that the sinuses appeared normal, and Dr. Hunt's belief that the toxæmia might account for the condition, led us to postpone operative interference, which, judging from the outcome, was a fortunate decision.

In a paper by Dr. L. M. Francis (10) discussed by Dr. de Schweinitz, entitled "Two Cases of Acute Retrobulbar Neuritis Associated With Marked Acetonuria," some of the problems suggested by Dr. Hunt were considered. It is believed that a careful study of other forms of ocular disease may lead to important steps in our knowledge of the association of the nerve and retina with metabolic changes. Such studies are not lacking, but the direct connection is not easily established. In this case there was disease of the optic nerve, there were marked metabolic disturbances, and the progress to complete recovery was not a coincidence but an evidence of the ætiological relationship.

Miss E. P. M., age 23. Stenographer. Sept. 6, 1922. Right eye painful since May. Operation on the nose in Albany in July, the right posterior ethmoid having been drained. Had had severe right orbital headache since, with extreme tenderness in the brow and eye, with an area of analgesia over the inner angle of the eyebrow. Vision: right eye, light perception; pupil wide, immobile; fundus normal: left eye, $\frac{20}{20}$, Jaeger 1 to 20*cm;* pupil normal. Fields are described later, in connection with those of the previous case, to avoid repetition. X-rays negative.

Sept. 14th. Both nerves were congested but not swollen.

Sept. 16th. Vision, R. E. $\frac{20}{100}$. Dr. Monroe opened a posterior ethmoid cell or a wing of the sphenoid and thought that there was pus.

Sept. 22nd. Vision $\frac{20}{100}+$. The left nerve was a little more congested and there was some perivasculitis, but the edges of the nerve were clear.

October 2nd. Vision: R. E. $\frac{20}{70}$; L. E. $\frac{20}{20}$. Left blind spot enlarged. The right pupil remains large and immobile. It is wider than one expects with a third nerve paralysis alone and as if there were sympathetic irritation. Does not react consensually. Left, normal: contracts to light and consensually. The central vision improved gradually to $\frac{20}{15}$

on October 11th, $\frac{2}{3}\frac{0}{0}$ October 13th, and at times the right pupil would become less dilated without any apparent reason, and react slightly, and the next day would be dilated and immobile. The right nerve remained red with full veins.

October 20th vision in the right eye was $\frac{2}{3}\frac{0}{0}$ −1. On account of the slight enlargement of the left blind spot, the left middle turbinate was removed on October 24th by Dr. Monroe.

October 26th. Vision: right eye $\frac{2}{3}\frac{0}{0}$ full; left eye $\frac{2}{1}\frac{0}{0}$ +.

October 31st. Right pupil smaller, reacts to light direct and consensual.

There was a marked area of complete analgesia in the right supraorbital region and various symptoms of a neuritis. In addition, the toxæmic condition was very similar to that described in the previous case. She also developed symptoms of profound hysteria, with paraplegia and changing anæsthesia, anorexia, and insufficient elimination, which led Dr. MacPhee, who assumed charge of the case, to send her to a sanitarium and she is still under observation.

In this case we have changes in the field simulating and probably due primarily to sinusitis; profound toxæmia followed by major hysteria; pupillary changes which have puzzled neurologists who have seen the patient and which seem inexplicable:—certainly complications which illustrate the difficulty of diagnosis and the possibilities of which should never be ignored. The relations of the sympathetic nerves to the posterior sinuses have been described by Dr. Haskins, (11) and in view of the pupillary changes the influence of the autonomic system should be kept in mind. The relations of the motor nerves to the sphenoid are described by Haskins and Onodi.

The fields of vision in these two cases were not unlike. In the first instance, Miss J. D., the contraction was concentric at first in both eyes, clearing up gradually and leaving the blind spots enlarged, but with slight diminution of central vision and no central or paracentral scotomas. Evidently the central bundle was not affected. In about a month, as was noted, the eyes became normal in every respect. In the last case, Miss E. P. M., the left or better eye, was at first normal. Later the blind spot became enlarged and the nerve congested. In the right eye, vision at first light perception, gradually

improving to $\frac{1}{1}\frac{1}{1}$ or better, but always with a very marked concentric contraction of the field and almost complete loss of color perception except for red at the fixation point. This may be considered a hysterical field, especially in connection with the later developments, but the enlarged blind spot on the other (left) side, and the improvement of central vision after Dr. Monroe's operation and Dr. Hunt's treatment, lead me to believe that there was an organic basis as well. It would be interesting to give the charts of the fields and the blind spots but the kaleidoscopic changes which are characteristic of these cases make it impossible to delineate them adequately.

In conclusion, certain questions are pertinent which cannot be answered yet with confidence, but which should stimulate discussion.

1. Does sinus disease affect the eyes often enough to make it important to watch?

Yes. In a considerable number of cases the blind spot is somewhat enlarged, especially for colors, where there have been recurrent colds, particularly where the nose is obstructed by septum or turbinals. Such cases are advised to have the nose treated, but the question of operation is not raised unless the peripapillary scotoma increases or there are other defects of the field or other signs of retrobulbar neuritis. These patients can usually be helped, and danger avoided, by hygiene and care of the nose, but they should be watched and a thorough general examination should be urged.

This raises the question of the importance of an enlargement of the color margin of the blind spot. Van der Hoeve in his earlier paper put much stress on this symptom. It is present in many cases, but it seems unwise to base a conclusion on it without corroborative symptoms. It is, however, a frequent accompaniment and precursor of a true peripapillary scotoma. A case in point was seen recently in which the blind spots for form were at first nearly normal, but the loss for red and blue upwards was very striking. The nerves were congested, but not swollen. Vision normal. No central or paracentral scotoma. The patient had an acute condition affecting chiefly the posterior sinuses. Dr. Saunders considered that the condition of the nose and sinuses would improve in a week or ten days and that there was no indication for operation. The

later observations of this case showed a severe acute inflammation of both sphenoids, based on a chronic sinusitis. The blind spots became very much enlarged vertically. Central vision normal. Operation improved conditions and the nerves and vision are now normal.

2. Do we invariably get eye symptoms, and if some individuals escape, why are they immune? Would the great anatomical variation in cells account for this?

The percentage of sinusitis with eye symptoms is probably small. This is due to the protection afforded the optic nerve by the bony wall. In spite of Onodi's very striking statements and pictures, it is probable that the optic nerve is free in the sinus or exposed directly to its contents in comparatively few instances. If it were free, retrobulbar neuritis would be much more frequent than it is. Whitnall (*The Anatomy of the Human Orbit*, p. 29) states that the bony wall which separates the optic canal from the posterior ethmoidal or sphenoidal sinus is often only 0.5*mm* thick. Francis and Gibson (*loc. cit.*) found a very thin wall in 38% of cases. Dehiscences are rare, 1 in 50 skulls, 2 in 200, while Whitnall had seen but one case. A thin wall is, however, a poor protection against pus, especially in a shut in cell and under pressure.

3. Are we more apt to get an enlarged blind spot from posterior cell disease, and if so, why?

The reason for the association of retrobulbar neuritis with posterior sinusitis is contiguity, the narrow optic canal, and the vascular relations. Inflammation of the anterior cells, ethmoid, frontal and antrum, is important in this connection only when it forms a part of a pansinusitis; but it should be borne in mind that while the frontal and other anterior cells may be conspicuously inflamed, an unsuspected posterior ethmoiditis, possibly a shut in cell, may be the actual source of danger to vision. Of course, optic neuritis or uveitis may arise from inflammation of the antrum or other cells, as from any other distant focus, as tonsils or teeth, but that is not our problem.

4. What symptoms occurring in an eye patient should make us suspect sinusitis?

Peripapillary scotoma first, but that might attain considerable size before attracting attention. A small scotoma at or

near the fixation point would be noticed at once. Inequality of the pupils. Insufficiency of convergence and accommodation, and tenderness to pressure of the eye ball directly back, due to inflammation at the apex of the orbit; some pain on moving the eye, especially on convergence; sometimes temporal or parietal headaches; hyperæmia of the optic nerve, very rarely papillœdema—may be early symptoms.

After the detection of the neuritis, the symptoms of greatest importance are, the changing field, the variable blind spots and scotomata, which afford the chief guide to operative needs and to prognosis. If there are no ocular symptoms, sinusitis may of course exist. If, on the other hand, symptoms of retrobulbar neuritis are present, we must consider two types: First, stationary, in which we can safely await developments (and these are perhaps more frequent), and, second, the progressive cases, in which vision is threatened early and something must be done. In these, if no other possible diagnosis is available, the rhinologist should be asked to promote drainage in the most effectual manner, and if that is not sufficient, to explore the posterior cells, both ethmoid and sphenoid.

5. What other conditions are likely to be confused with this? And how can they be differentiated?

It is probable that the most frequent cause of peripapillary scotoma—excepting, of course, myopia, glaucoma, medullated nerve fibers, and choked disk, all diagnosticable with the ophthalmoscope, is an inflammation or pressure affecting the optic nerve in its canalicular portion. Three autopsies are on record. In two a tumor of the sphenoid caused a central scotoma by pressure on the axial fibers. In the third, pansinusitis, the extension of the inflammation through the bony wall to the sheath of the nerve was shown. Unfortunately no reference to the scotoma is made. (Van der Hoeve, de Kleyn and Gerlach.) But there may well be diseases which would cause these symptoms. I have mentioned three: Aneurism of the circle of Willis, possible encephalitis, metabolic toxæmia, and a fourth, with possible sinusitis complicated by toxæmia and a profound hysteria. It is well to remember Van der Hoeve's words in speaking of central scotoma including the blind spot:

"These symptoms are important as they are symptoms not of a sinus affection but of an affection of the optic nerve. They show that the optic nerve is diseased but do not teach us anything about the origin of this affection and we always must remember that every retrobulbar neuritis can begin with these symptoms whether it is caused by multiple sclerosis, by tuberculosis, syphilis, dental infection or rheumatism, or by nasal disease."

In a recent paper by Emory Hill (12) an enlarged blind spot is mentioned as a fairly frequent symptom of pituitary disease. A very interesting paper by Walter E. Dandy (13) describing the prechiasmal intracranial tumors of the optic nerve, should be read with care. There are some points in this paper which arouse the interest and stimulate the specialist to renew efforts in the field of a more exact diagnosis, which, in spite of Dr. Dandy's predictions, often seems elusive. It would be of great interest to discuss these subjects from the standpoint of the ophthalmologist.

6. (a) What is the prognosis untreated?

(b) How long can we delay operation, and what ocular improvement is likely?

(c) Should we insist or merely advise? What results have we seen in actual purulent sinusitis? In cases with negative rhinological and X-ray findings, from simply drainage?

(a) Good, if the case is not progressive and acute, with drainage and care of the nose. Bad, in the severe and purulent cases, if neglected.

(b) Restoration of vision has been obtained promptly in recent cases; even where vision has been much impaired for a considerable time, partial relief has been obtained by an adequate operation, and in one case (*Jung. Gr. Arch.*, lxxiv., p. 266) of complete blindness for at least ten days, with profuse purulent discharge, vision of one-third of the normal was obtained by treatment with adrenalin and suction without operation.

In most cases where the diagnosis has been established and the optic nerve has not suffered irreparably, improvement can be expected if drainage of the infected sinuses is accomplished.

(c) It does not seem the part of the ophthalmologist to dictate to the rhinologist, especially when the X-ray and

rhinological findings are negative. But there are exceptions to this rule. Every case is a law unto itself. Van der Hoeve deals with the subject judicially and in his paper, and in my conclusions in the *Laryngoscope*, August, 1922, stress is laid on the need for conservatism in diagnosis, with all reasonable attempts at the simple methods of treatment compatible with preservation of vision.

Let me repeat: Most of the cases with Van der Hoeve's symptom are probably cases of retrobulbar neuritis with sinusitis. In these the sinuses and the eye must be studied simultaneously and with equal respect, and with due regard for the history, the condition of the pupil and convergence and accommodation, with pain, and tenderness on pressure, the diagnosis is usually possible. The treatment depends entirely on the nature of the case and is chiefly influenced by the vision.

In a few cases such as I have described, the diagnosis will be more difficult. I think these may be considered exceptional, but it may be that as attention is directed to the subject they will be found to be more numerous. In any event the complications of diagnosis may well cause an ophthalmologist some scruples when urging what seems to be a major operation, even in the most competent hands.

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CONCERNING THE SURGICAL TREATMENT OF GLAUCOMA, WITH SPECIAL REFERENCE TO A MODIFIED ELLIOT-LAGRANGE TECHNIC.[1]

By Dr. DERRICK T. VAIL, Cincinnati, Ohio.

(With one figure in the text.)

IN dealing with this subject, the surgical treatment of glaucoma, there are four main types of the disease to consider, viz.:

(1) Acute inflammatory glaucoma.
(2) Subacute inflammatory glaucoma.
(3) Secondary glaucoma.
(4) Chronic non-inflammatory glaucoma.

Since the surgical treatment in these four general types varies, much may be written but I shall dispose of the first three types, viz., acute inflammatory, subacute inflammatory and secondary glaucoma, with a few words, not that they are unimportant but because their surgical treatment is generally well understood and usually satisfactory.

ACUTE INFLAMMATORY GLAUCOMA (FULMINATING GLAUCOMA).

In acute inflammatory glaucoma there is a sudden onset of great pain, marked œdema, chemosis, redness, and rapid loss of vision. The surgical treatment is a von Graefe iridectomy. This operation should be done without delay. The incision, starting well back of the limbus, is carefully executed with a sharp keratome, the iris is then grasped with iris forceps, carefully withdrawn and the iridectomy executed with two snips

[1] Read before Ohio State Medical Society at Dayton, Ohio, May 2, 1923.

of the iris scissors. First the right arm of the withdrawn iris is cut, then some stripping is employed to tear the iris loose at its root and finally another snip cuts the left arm of the withdrawn iris. This operation, successfully executed, usually puts an end to all symptoms, the eye generally recovers with excellent vision and the cure is actual and permanent as a rule. Acute inflammatory glaucoma is a rare disease. In a large ophthalmic practice extending over many years I have not encountered over a score of typical cases.

SUBACUTE INFLAMMATORY GLAUCOMA.

Subacute inflammatory glaucoma is that type in which there occur exacerbations of hypertension within the eyeball causing acute redness, pain, visual halos, and some loss of vision during the storm but in which during the intervals between the attacks there is usually at first no marked evidence of the disease: the vision in the interim is usually excellent, the fields of vision are either normal or fairly good, the optic disk is usually not markedly cupped and there is not much if any ophthalmoscopic evidence of atrophy of the optic nerve.

In this type of glaucoma eserine solutions dropped in the eye at short intervals will usually abort the attack and bring about rapid and remarkable relief of all symptoms. Unfortunately each recurrent attack seems to add a little more to the damage done to the intraocular tissues and leaves the eye more prone to further and more frequent attacks so that the cure is not permanent. The disease, or "glaucoma habit" as it may be called, is permanently established and hence the prognosis is that blindness will sooner or later supervene. When blindness does finally occur we note the presence of dilated pupil, shallow chamber, deep cupping and atrophy of the optic nerve head, engorged conjunctival blood vessels and marked plus tension of the globe. These eyes take on a certain marble-like appearance and constitute the so-called "glaucoma absolutum."

Knowing full well what the ultimate fate to the sight will be the question is, shall we be satisfied to employ eserine drops and temporize through attack after attack? It requires some courage to operate for the relief of this type of glaucoma for

we know that eserine solutions will abort the attack, and the patient also knows that medicines dropped in the eye will afford relief, nevertheless we should advise operation. Personally I am satisfied with performing what is now, in some places, called a "Smith iridectomy."

The Smith iridectomy is performed with a narrow-bladed sharp Graefe knife. The point of the knife is made to enter the eyeball far back from the limbus and is advanced until it appears in the anterior chamber. The blade is slowly pushed still further until the point reaches the upper margin of the pupil. Then the handle is lowered to cause the point to enter the extreme angle of the cornea behind the limbus and then the knife is turned so that the edge is vertical with the cornea. The incision is now quickly made by lifting the handle of the knife to cause the edge to cut from place of entrance to the point of the knife blade (not by counter puncture and sawing). The iris is then picked up with iris forceps and abscised with two cuts as described above where mention is made of the iridectomy in acute inflammatory glaucoma. This operation is not difficult to perform and usually (though unfortunately not always) establishes permanently normal tension without the occurrence of further attacks. I am certain after much experience with many operations that the results with the so-called "Smith iridectomy" in this type of glaucoma compare favorably with those of any other operation in vogue and to me this is (in this type of glaucoma) the operation of choice.

SECONDARY GLAUCOMA.

The surgical treatment of secondary glaucoma, depends upon the primary disease or cause. If it be cyclitis or uveitis, operation is often not necessary for the disease may depart if atropine is withdrawn, eserine in weak solution substituted, hot moist applications resorted to along with a good calomel purge and rest in bed. Salicylate of soda administered inwardly will have a more favorable influence on the disease than iodide of potash for the latter, on account of the liberation of free iodine in the aqueous humor, is very irritating to the already inflamed iris; indeed, I have often observed that glaucoma asserts itself in cyclitis in those cases where K. I.

has been administered and have, in these instances, thought it to blame for the production of the complication.

In some cases of this type, especially when it is discovered that eserine does not relieve the tension, it is best to stop its employment and resort to paracentesis of the cornea with a small but actual incision through the limbus on one side performed with a sharp Graefe knife.

In cases of glaucoma secondary to the needling operation for cataract or in cases of glaucoma complicating traumatic cataract in young subjects it is necessary to perform a linear incision through the clear cornea opposite the middle of the iris above by means of a keratome and evacuate the swollen lens substance with a curved grooved spatula or Daviel spoon pressing on the upper or limbal side of the incision, and this supplemented in some cases by irrigation of the anterior chamber with warm normal saline solution.

The best surgical treatment for glaucoma, following long after cataract extraction, is iridectomy of that arm of the iriscoloboma that is adherent to the inner side of the wound.

Much more should be written concerning the surgical treatment of the above-mentioned types of glaucoma as well as in their variously modified expressions for I have not given them the notice their importance deserves but my paper is written to deal with the much more common type of glaucoma, the non-inflammatory form, or what was formerly called "Glaucoma Simplex," the type of glaucoma of which we see the most and about which we know the least both as regards its cause and its surgical management.

Let us first generalize in our remarks concerning chronic non-inflammatory glaucoma and then specialize as regards its surgical treatment.

The textbooks' description: "Glaucoma is a disease of the eye *due to* increased intraocular tension" should read "Glaucoma is a disease of the eye *causing* intraocular tension," for there was especially in the case of so-called "glaucoma simplex" at least, a potential pathological process at work within the eye, we will state long before there was any demonstrable rise of tension.

I have seen many cases of glaucoma-cupping of the optic

disk with atrophy of the nerve well advanced and exhibiting typical so-called "glaucoma fields" with failure of vision amounting to nearly total blindness in which the tonometer registered no increase of ocular tension or at most only a very slight increase. The ratio between the tension and the failing vision is predominantly toward the visual failure. These patients are usually very senile and the prognosis is not improved by any operation.

In another group of cases of apparently the same disease, distinct rise of tension may exist for a long time before there is marked cupping or atrophy of the optic disk. The ratio between the plus tension and the failing vision is predominantly toward the plus tension. These patients are usually not markedly senile and the prognosis is greatly improved by suitable operation.

If you employ a mydriatic in either of these groups of cases you will convince yourselves that the disease is glaucoma indeed, for the pupil remains dilated, the tension becomes distinctly plus, the cornea becomes hazy, slight redness persists and vision is sharply affected—in other words the patient's chronic glaucoma will become acute and the eye will not return to its former state.

In this disease, simple chronic glaucoma, now that we have instruments of precision: ophthalmoscopes, tonometers, perimeters, standardized test types, focal illuminators, transilluminators, slit lamps and what-not, the march of the pathological processes and the succession of clinical events become a fascinating study.

As to the cause of this type of glaucoma we are still in profound ignorance. Some knowledge we have to be sure but the real cause or causes are unknown. Dr. Martin H. Fischer of Cincinnati, after lecturing before the Cincinnati Ophthalmological Club at its annual dinner, November, 1922, on the subject of glaucoma, was asked what, in his judgment, was the cause of chronic non-inflammatory glaucoma. His answer was "arteriosclerosis of the nutrient vessels supplying the globe of the eye." He then stated: "Arteriosclerosis is a spotty disease—it occurs in spots. Witness what occurs in the cortex of the brain as a result of arteriosclerosis of the cerebral arteries in the aged. The same process is at work in the blood vessels

of the optic globe in glaucoma simplex. The vasa vasorum become obliterated, the blood vessel walls become thickened, the lumina are reduced in caliber and as a consequence there is not enough blood circulating in the nutrient capillaries of the eye. This results in oxygen starvation and there is produced secondarily an abnormal accumulation of acids which makes the tissues of the eye swell. In consequence of this pressure, sight is destroyed and the optic nerve cupped. Through the rise of intraocular tension the iris is pushed forward and in this way the filtration angle is pressed upon. Obliteration of the filtration angle is therefore not the cause but a *consequence* of glaucoma. Such pressure upon the iris makes for further blood stasis so that a 'vicious circle' is established."

I asked a well-known ocular pathologist (Dr. Francis Lane of Chicago) if he had ever sectioned the optic nerve in glaucoma simplex. He informed me that he had and that there was arteriosclerosis of the central artery. He said there was a typical atheromatous process at work within the vascular system of the optic nerve.

It is without the province of the paper to discuss this subject further. I only mention the thoughts and findings of these two men who have studied the disease further than perhaps any of us.

As for the treatment of chronic non-inflammatory glaucoma, eserine in solution dropped in the conjunctival sac does well for a while but not for an indefinite period of time. Careful tests conducted from time to time in these cases will prove the disease is marching steadily on. We must operate on most of them before it is too late. Knowing that some of the remaining field of vision (at least 5% of the periphery) is apt to be lost after the most successful operation it behooves us to resort to operation before any part of the periphery of the remaining field reaches 20° from the center of fixation. I apply the following rule: use eserine solutions dropped in the eye frequently enough to prevent hyperocular tension so long as there is no further loss of visual acuity or of the field of vision but when eserine drops fail to control the tension, retain the vision and the field of vision in statu quo ante, operate before it is too late.

OPERATIVE TREATMENT OF CHRONIC NON-INFLAMMATORY GLAUCOMA.

The various operations devised to meet the requirements of these cases are all matters of record and I need not take time to recount them. I shall limit my report to two procedures—one an experimental procedure that resulted in failure, another a modification of two well known procedures which has given, in my hands, better results than either performed alone.

A seton operation: I devised this operation many years ago and reported it in the *Ophthalmic Record* (Chicago). It was performed with the idea of draining the watery fluid contained in the vitreous humor along heavy silk threads passed through the sclera at the equator of the eyeball to cause it to steadily flow out of the vitreous chamber to reach the space of tenon. The current in the lymph space of tenon is constantly flowing backward and it seemed to me that to connect the vitreous chamber with this large lymph channel would not only permanently reduced the intraocular tension but would better imitate nature's plan of drainage than in causing the flow to occur under the conjunctiva in the anterior segment of the eyeball. Moreover, by this plan that the pupil was left undisturbed and that there would be no scar or wound in the limbus and hence the danger of later infection would be greatly reduced or entirely prevented.

In the case reported in the *Ophthalmic Record* (above referred to) I applied the seton drain in an eye totally blind from glaucoma in which pain was a prominent symptom and it acted well. I determined to use it in a suitable case of glaucoma simplex.

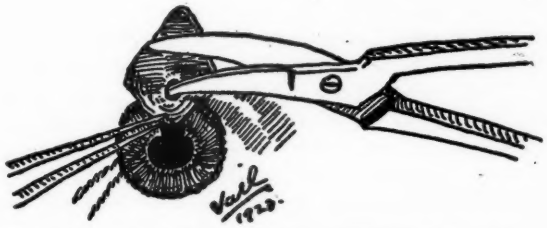
I shall not weary you with a recital of the technic. It was an easy operation to perform. I used two strands of heavy No. 10 plaited white silk thread effectually connecting the vitreous chamber with the space of tenon. The result was strikingly beautiful. The eye bore the silk without any sign of irritation. There was no pain and no intraocular hemorrhage. The tension, which I followed closely, was reduced from 48*mm* before operation to 24*mm* afterward (Gradle tonometer) and it remained 24*mm* or less for a year during which time the vision and the field of vision remained un-

changed. I thought I had made a valuable discovery for ophthalmology. After twelve months the tension slowly began to increase. It became 30*mm* and 36*mm* and the field of vision which had remained stationary became further encroached upon. When the tension became 36*mm* I determined to explore and see why there had been a return of glaucoma. I laid back the conjunctiva and searched for my thread. There was no sign of thread, it had entirely absorbed! I found the healed scars in the sclera but no vestige of thread. My "discovery" was a failure.

A MODIFIED ELLIOT-LAGRANGE OPERATION.

The sclero-corneal trephine operation is open to the objection that there is danger of the trephine hole becoming primarily blocked with shreds of lymph and blood clot thus bringing failure.

The LaGrange operation is technically more difficult to perform than the sclero-corneal trephine operation of Elliot



The author's method of converting an Elliot operation into a LaGrange effect.

but not so apt to be followed by primary closure of the wound because there is a longer opening connecting with the aqueous chamber and a wider field of drainage.

I hit upon the plan of performing a careful trephining of the sclero-cornea, executing the iridectomy through the trephine opening in the usual manner, and then with blunt scissors, the point of one blade entering the trephine opening, making a 3*mm* cut through the sclero-cornea parallel with the periphery of the cornea to the right, then re-entering the point

of one blade of the scissors in the trephine hole making another 3*mm* cut through the sclero-cornea to the left. This technic establishes an 8*mm* opening connected with the aqueous chamber with the trephine hole in its middle and all located at the extreme angle of the aqueous chamber: 2*mm* for the trephine opening, 3*mm* cut to the right and 3*mm* cut to the left.

This technic, which in my hands, is simpler and safer than a LaGrange operation seems to accomplish all that this operation when well executed accomplishes. It seems that the trephine hole in the middle cannot close until after the cuts to either side have closed and by that time the stage of acute traumatism has passed and the hole will remain open. Also that the conjunctival flap is not forced up by a round stream of aqueous spurting through the hole but by a flat stream distributed over an 8*mm* area.

I have performed this operation upon twenty-one eyes within the past two years with excellent immediate success in all and with only two ultimate failures.

The eyes affected with simple chronic glaucoma that were operated upon in the manner described with successful results continue to show the ravages of the disease checked but unchanged as regards the fundus. As a rule they suffered only slight further loss of visual acuity following the operation. Some later on regained what vision they had before the operation and others never regained what they lost as the result of the operation. The further progress of the disease in these successful cases seems to be arrested. None of the patients upon whom this operation proved successful have used miotic-inducing drops of any kind since the operation and in all nineteen the operated eyes remain soft in tension.

SEROUS TENONITIS COMPLICATED BY BILATERAL PAPILLŒDEMA.

By Dr. G. N. BRAZEAU, Milwaukee, Wis.

(With one illustration on Text-Plate XXX.)

PEUCHAGUT clearly established the pathology and symptomatology of tenonitis. If we add the formidable complication of papillœdema to this rarely observed disease, we will have a most unusual condition and one bordering on the unique.

Case History.—Nothing appears in the history of this case which can be construed as having any bearing upon it. The patient, a healthy man, thirty years of age claims that he has always been well previous to this attack. He denies ever having had either ear, nose, or sinus disease and says that his sight has always been very good. Early last November, pain together with an annoying diplopia developed first in the right eye and shortly afterward in the left. By the end of the month both eyes had become so swollen and so painful that he had to give up his work of driving a milk wagon. Pain with consequent loss of sleep caused him to lose thirty pounds in weight.

Physical Examination.—In February, I saw the patient in consultation with Dr. J. B. Hervey. The three symptoms which arrested my attention and which are pathognomonic of tenonitis were:

(1) *Bilateral Exophthalmia.*—The right eye protruded about five millimeters beyond the orbital margins and the left about ten millimeters. Both eyes were fixed and directed straight ahead.

(2) *Ophthalmoplegia Externa.*—The eyes appeared as though frozen in their sockets. Their immobility was complete. The intraocular muscles remained intact throughout the course of the disease.

(3) *Chemosis.*—The chemosis in the left eye extruded itself between the swollen lids as a deep red edematous mass about ten millimeters in thickness while the chemosis in the left eye was confined to a mere puffiness of the conjunctiva. The ptosis of both lids was due to the œdema. There were no secretions from the conjunctivæ. Slight lachrymation was present.

An examination of the fundi revealed marked venous congestion with a thinning of the arteries. Both nerve-heads were swollen and their margins were obscured in the mass of infiltration. The swelling in the nerve head on the left side equalled about four diopters while that on the right about one diopter. The fundi were otherwise normal. The vision was $\frac{20}{20}$. The conjunctivæ were slightly red due to passive congestion. All ear, nose and sinus diseases were eliminated by ocular and Roentgenologic examinations of the head and face. The sphenoidal fissures were blurred. Examinations of the blood and urine were negative. Reflexes were normal.

The principal complaint made by the patient was about the pain which, he said, was driving him almost crazy.

Diagnosis.—Two conditions immediately suggested themselves to me viz. tenonitis and orbital phlegmon. A differential diagnosis between these two conditions is sometimes very difficult. Phlegmon was eliminated for the following reasons: the absence of all signs of suppurative inflammation, the lack of pain and tenderness on pressure, the absence of discoloration of the lids, and the fact that a phlegmon is usually unilateral and that its origin can usually be traced to some source of infection. Orbital tumor is likewise generally unilateral and the tendency is for it to displace the eyeball in the direction of its growth. The development is very slow. The presence of papillœdema led to a belief in the possible existence of a brain tumor since it is, in the great majority of the cases, the cause. Out of two hundred cases of papillœdema, one hundred thirty-four were found to be due to cerebral tumors (Kampherstein). Therefore, the rôle played by such other general causes as dyscrasias, intoxications, etc., is minimal. A tumor was excluded for want of motor and sensory disturbances. The diagnosis resolved itself into a probable tenonitis of endogenous origin with papillœdema as a complication. Subsequent events proved the correctness of this diagnosis.

Ætiology and Pathology.—Rheumatism and gonorrhea are by far the commonest causes of tenonitis. Rheumatism proved to be the ætiological factor in this case. But, was it also the cause of the papillœdema? Most of the cases reported in ophthalmic literature on optic nerve involvement

ILLUSTRATING DR. G. N. BRAZEAU'S ARTICLE ON "SEROUS TENONITIS COMPLICATED BY BILATERAL PAPILLŒDEMA."

A case of tenonitis.

in tenonitis showed, by visual disturbances in varying degrees, that the inflammatory process must have invaded the optic nerves directly. In these cases rheumatism was not prominent as the cause because of its frequency. This is understandable, since rheumatism is not known as directly attacking the optic nerves. The absence of all visual troubles, in this case, tends to prove that the papillœdema was most probably due to pressure on the optic nerves from fluid in the capsule of Tenon. Graefe's mechanical theory regarding the production of papillœdema receives confirmation here. Rheumatism acts upon Tenon's capsule as it does upon the para-articular bursæ because these structures histologically resemble each other. Because of the violent nature of its symptoms and the presence of papillœdema with rheumatism as its very uncommon cause, this case of tenonitis needs must be classified as a very rare form of the disease. The splendid condition of the patient served as my mentor and made it possible for me to offer a favorable prognosis at a time when surgical interference was urged as the only hope of relieving the threatened optic nerves.

Prognosis.—The prognosis in tenonitis is ordinarily good. Violent cases like this one may arouse great apprehension in the minds of both the patient and the physician alike. Papillœdema impels us to great reserve regarding the prognosis both as to life and its effects upon the vision.

Treatment.—Ten grains of salicylate of soda with five of aspirin were prescribed three times a day. The pain ceased after the second dose. After five or six weeks of treatment, the movements of the eyelids were restored by the disappearance of the fluid in them which had, up to this time, resulted in complete ptosis. The chemosis together with the exorbitism also disappeared with the result that the eyes returned to their original positions in the sockets. The patient returned to work greatly improved. The ocular movements were normal in every direction excepting when the patient looked upward and outward. There remained a paralysis of the inferior oblique muscle in the left eye which caused the eye to turn slightly inward and downward with a resulting homonymous, vertical and horizontal diplopia which the patient learned to avoid by slightly turning the head. This is improving and the probabilities are, that the paralysis will entirely disappear in time as the double images are coming closer and closer together and therefore less annoying. This remaining paralysis of the inferior oblique adds another interesting feature to this already anomalous condition because such isolated paralysis is very rare indeed.

A NEW TECHNIQUE FOR THE APPLICATION OF THE REDUCED SILVER NITRATE METHOD OF CAJAL TO SECTIONS OF THE RETINA.[1]

By Dr. FELIX FERNANDEZ BALBUENA, Gijon, Spain.

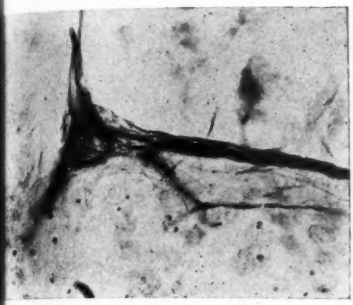
(With seven illustrations on Text-Plates XXXI. and XXXII.)

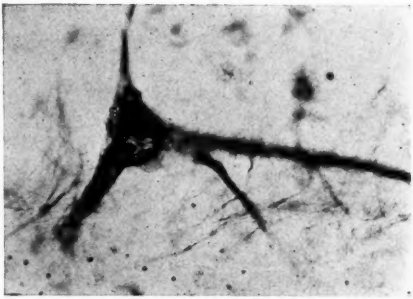
AN analytical study of the method invented by Simarro: (1) to stain neurofibrils with salts of silver gave to Cajal; (2) the idea of the method universally known as the "Cajal method of reduced silver nitrate." The numerous ways thought of by this author: (3) and the great many new facts discovered by Cajal and his students with the aid of this wonderful method make it one of the most powerful resources and a most efficacious technique as applied to modern histology.

The Cajal method consists, as is well known, in the impregnation of the nervous tissue of the newborn with colloidal silver. By this method the blocks of nervous tissue should be immersed in the silver nitrate solution and kept in incubator at 37° (C.) for a few days. Then it is immersed in a solution of hydro-quinine for 24 hours, finally being put in, or held in celloidin, and we are ready to make the sections. The obtained results vary according to the fixing fluids used, the most common being alcohol 96%, ammon., alcohol, formol, chloral hydrate, pyridin, and others. To practice silver impregnation, and the repeated reduction in block, of the nervous tissue which is being studied has the disadvantage that when the reaction is not obtained we altogether lose the section under study, and for this reason ever since Cajal published his method other authors have tried to apply it to histological

[1] Presented in part at International Congress of Ophthalmology, Washington, May 22d.

...USTRATING DR. FELIX FERNANDEZ BALBUENA'S ARTICLE ON "A NEW TECHNIQUE FOR THE ...PLICATION OF THE REDUCED SILVER NITRATE METHOD OF CAJAL TO SECTIONS OF THE RETINA."





FIGS. 1 and 2. Rabbit's retina. Ganglion cells. Neuro-fibrils.

3. Rabbit's retina. Large horizontal cells in external plexiform layer.

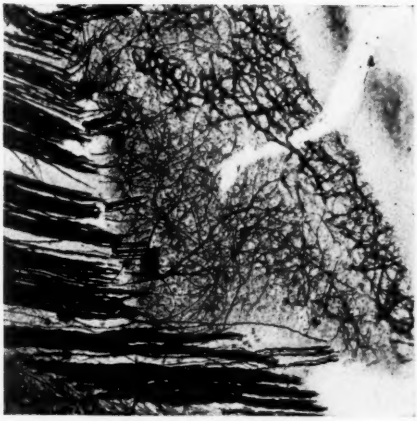


FIG. 4. Rabbit's retina.

sections. Cajal himself, when he first published his technique, made several attempts with this object in view. Liesegang, in his experiments, applied it to gumma and obtained good results; but according to Cajal, Liesegang's procedure gives a very dark background and neurofibril colorizations somewhat coarser and more varied than those obtained by reduction en masse (4). The method of Lugaro (5), which is based on colloidal silver and which is also applicable to tissue sections, according to Cajal gives good results in the retina but is not quite so clear in the nerve centers. Recently Cajal, after abandoning for 15 years his experiments with the nitrate treatment of sections, has resumed his observations and has now arrived at a very easy formula by which he has obtained excellent results, especially in the cerebellum. He explains his reactions by the fact that when the reducer is dissolved in a considerable quantity of formol and acts in weak solutions we are able to prevent superficial metallic deposits, and vigorous selective colorations are obtained.

He employs fixation in formol, sections by freezing, impregnation in 2 per cent. silver nitrate, to which are added a few drops of pyridin. Before the tissue sections are developed, he places them for about ½ minute in 96 per cent. alcohol. Then he finishes with reduction in a weak solution of hydroquinine in formol and distilled water.

He has succeeded in staining in the cerebellum the basket cells and the transverse fibers of the molecular layer, the climbing arborizations of the parallel fibers, and the reticular fibers of the granular layer; in man especially the dendrite branches of Purkinge's cells; in the cerebrum the fine medullated plexus of the gray substance and the fibers or radiating bundles. The pyramids are stained brown.

Regarding the staining of neurofibrils, Cajal notices that sections impregnated from two to six hours in the silver bath do not stain the neurofibrils at all in the cerebellum, and that they are weakly stained in the cerebrum. On the contrary, the terminal arborizations are clearly shown.

In the tissue sections impregnated in cold solutions from one to two days, especially if they have remained for a long time in formol and are obtained from man, there is a selective coloration of the neurofibrils. Cajal notes that with his new

formula occurs something similar to that which takes place in Bielschowsky's method, that is, it only stains the neurofibrillar frame work in the sections that have been subjected for a long time to the action of formol and have remained for a long time in silver nitrate. It is also a characteristic of his formula to impregnate intensely the chromatin of the nervous and neuroglic nuclei and, in some instances, the "casquetes" of nuclein situated around the nucleus.

When I undertook my experiments to apply reduced silver nitrate to tissue sections, Cajal had not yet published his new formula. The theoretic considerations shown by Cajal in the *Memories of his Life* (vol. ii.), referring to his first method, and the indications contained in the same book about Liesegang's method led me to try different techniques. I am now going to tell every experiment, test, and failure I have undergone. I will review briefly the technique I have employed and the results obtained. But I must say that my work is not yet finished; there are several questions that have to be ascertained from new experiments. Nevertheless, as the preparations of the retina obtained with the technique that I am going to describe have been approved by Cajal, I offer this introductory note as a prologue to a more elaborate work.

TECHNIQUE.

1. *Rolling up of the Retina by Cajal's Method* (7). If we are experimenting on small animals, we leave the retinal block resulting from the rolling-up of the retina, held by the optic nerve to a round segment of the eyeball. This facilitates successive manipulations. Once the specimens are fixed, we totally remove the retinal block. In the large retinas, such as those of the bull or sheep, we make several blocks in order to facilitate the penetration of the fixing fluid. If we wish to study particularly the rods and cones, it is preferable not to remove the retina, but to operate on small fragments of the eyeball. (When we apply the reaction to perpendicular sections of the retina, it is more difficult to follow the reaction than when we work on sections derived from the rolled-up retina, as in the last case the field of observation is much more extensive.)

STRATING DR. FELIX FERNANDEZ BALBUENA'S ARTICLE ON "A NEW TECHNIQUE FOR THE LICATION OF THE REDUCED SILVER NITRATE METHOD OF CAJAL TO SECTIONS OF THE RETINA."

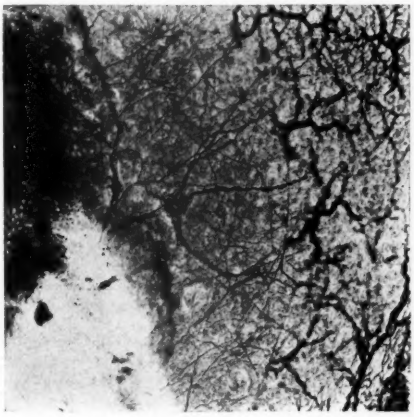


FIG. 5. Rabbit's retina. Ganglia.

FIG. 6. Human eye. Rods and cones.

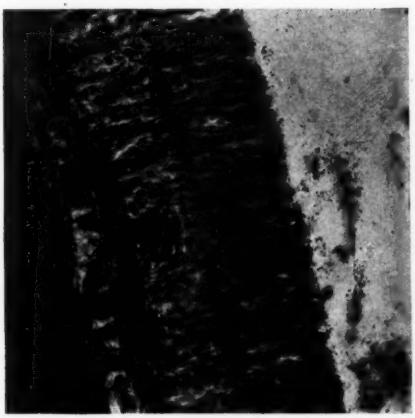


FIG. 7. Human eye. Enucleated for sympathetic ophthalmia.

2. *Fixation of the Retinal Blocks in Absolute Alcohol (50 c. c.) with Pyridin (5 to 10 c. c.) according to Formula 2aB of Cajal.*—We also use absolute alcohol alone, or ammon. alcohol as in the classical method. The retinal blocks remain in the Fixation fluid 12, 24, or 48 hours, according to the thickness of the specimens. When the specimens are once fixed, they are washed in several changes of absolute alcohol, imbedded in celloidin, and mounted on corks, after which operation they are immersed in 70 per cent. alcohol, whereby is ascertained

3. *The Sensitization of the Specimens.*—The blocks mounted on cork should remain in 70 per cent. alcohol from a few days to two or three months. After four or five days we begin to obtain results. This third operation is usually decisive, and we call it provisionally "sensitization of the retinal block," since it appears that without a more or less prolonged impregnation of the blocks in 70 per cent. alcohol the succeeding operations of nitratization, developing, and virado of the sections will be failures. We suspect that the sensitizing substance is derived from the cork, and is soluble in 70 per cent. alcohol, as we have been able to observe that this alcohol turned yellow after dissolving substances derived from the cork. It seemed to be more efficacious in the sensitization of the specimens. (We point out this observation as being merely accidental.)

4. *Impregnation of the Sections in Silver Nitrate.*—After the retinal blocks have undergone the impregnating process described, sections are made which are grasped with a little paint-brush and deposited on the bottom of a porcelain or glass vessel still moistened with the alcohol which we have used for lubricating the blade of the microtome; then 5*c.c.* or more of a one per 2000 silver nitrate solution, to which a few drops of pyridin (5 or 10 drops: 20*c.c.*) have been added, are poured over the sections. In some instances we have used solutions of one per 16.000 and more. When the sections are saturated, we slowly heat the solution until a slight steam rises, whereupon we let the solution cool off. Sometimes it happens that the section does not assume a yellow color as in the case when the conditions are favorable to impregnation. In such cases the solution is heated several times until the yellow color appears. Generally from three to ten minutes of imbedding

in the silver nitrate bath is sufficient, and then we are ready to add the succinum tincture to prepare the colloidal medium.

5. *Preparation of the Colloidal Medium and Developing of the Sections.*—Three or four drops of the tincture of yellow amber added to the silver nitrate bath impart to the solution a colloidal consistency. Afterwards, two or three drops of a one per cent. hydro-quinine solution are added, at the same time shaking the vessel to render the mixture homogeneous. When the reaction is favorable, a gradual deepening of the color of the sections and a clear difference of the various regions is noticed. The time in which the sections remain in the developing fluid varies from four to ten minutes. By watching the effects, we determine when we should stop the process. By a little calculation we easily arrive in each case at the desired result. In some cases it is necessary to assist the reaction by slow heating over the alcohol lamp.

6. *Replacement and Fixation.*—When the sections are developed, they are washed in the same vessel with distilled water. Then we pour on them a one per cent. borax solution and three or four drops of a one per cent. yellow chlorid of gold solution. We finish the process by fixation in a 5 per cent. hyposulphite solution, wash in distilled water, clear in creosote oil of oreganum, and mount in balsam. As may be observed, our technique is based on those of Cajal and Liesegang. But there is a period on which we lay emphasis, and this is the one called *Sensitization of the Block.* We have noticed several times that sections of blocks that had not suffered impregnation in 70 per cent. alcohol did not show a selective reaction producing abundant precipitates, while in sections derived from the same block after its impregnation for several days in 70 per cent. alcohol the reaction was shown very clearly; if it was incomplete, it always began on the borders of the sections.

WITH THE PURPOSE OF INQUIRING WHICH COULD BE THE SENSITIZING SUBSTANCE, I HAVE PERFORMED THE FOLLOWING EXPERIMENTS:

1. Blocks of nervous tissue imbedded in celloidin, immersed in 70 per cent. alcohol for a period of a few days; sections by freezing, impregnated and developed: The result is negative.

2. Tubercle quadrigeminum of the cat, fixed for two days

in absolute alcohol which has acquired a yellow color because of the dissolution of the cork. The sections from this specimen impregnated in silver and developed as described show a selective reaction about the borders and in the neighborhood of the aqueduct of Sylvius; that is to say, in those parts impregnated with 70 per cent. alcohol.

3. Fixation of nervous segments in absolute alcohol with tannin 1 per 1000. The successive impregnations with silver and the developing have been negative (D).

In regard to the fixation fluid used we have adopted the mixture 2B of Cajal, bearing in mind the advantages of the pyridin. This substance was used by Donaggio (9) as a fixing fluid for the purpose of staining neurofibrils. Lugaro and Held have recommended it as a fixing fluid for specimens which are to be stained with reduced silver nitrate (10). Cajal adopted it in his studies concerning neurogenesis and in his investigations about the degeneration and regeneration of the nervous system (11). Bielschowsky uses it also in his modified method (12). As is well known, pyridin helps in the penetration of the silver nitrate and makes it more constant, more regular, and causes a finer precipitation of the silver. Besides, it belongs to the group that Cajal has called *accelerator substances*.

For the preparation of the colloidal medium I have closely followed the ideas of Liesegang. I have also tested several substances, especially tinctures of myrrh, benzoin, and succinum, which have never been used before. In my first test I used silver solutions from 2 to 5 per cent. After several experiments I have adopted solutions of 1 per 2000 and even as weak as 1 per 32.000, and have made use of the tincture of succinum. As a rule, I have begun by using solutions of 1 per 2000, which I have modified according to the circumstances.

I have not yet finished my research. I must still determine by new experiments some peculiarities, but already I am able to show as characteristics of my new technique the following:

1. The possibility of applying silver impregnation to tissues imbedded in celloidin.

2. Activity and rapidity in the staining of the reticula.

While with the known methods of applying silver nitrate to the sections very long impregnations in the silver bath are needed if we wish to stain the neurofibrils, we obtain with my

new technique within three or ten minutes—especially in the retina—a fine, clear, and selective neurofibrillar staining. Sometimes it happens that when the blocks are sensitized (and I employ solutions in large quantities) only the ganglionic fibrils are stained, and the plexiform zones project energetically against the colorless retina. Another feature is the staining of the cones and the external portion of the rods—something which has never been obtained so far with reduced silver nitrate.

Results Obtained.—The best preparations are those of the retina of the rabbit and the human retina. So far I have studied the use of the described technique in four human eyes, enucleated because of sympathetic ophthalmia, in aspegillar infection, in tumor of the ciliary bodies, and in absolute glaucoma. In all these cases the cones and the external structures of the rods were shown. The foot of the cone appears almost always empty. Without doubt, it is a degenerative phenomenon. The granular chromatin appears finely stained in some of the blocks, but as I am operating with sick retinæ the reticulum does not appear, because it has been destroyed. In the retina of the rabbit the large, medium, and small ganglia are well stained. The chromatic spherules of the nucleolus are shown very clearly in some instances. The reticulum of some spongioblasts is also stained, although not quite so clearly. The plexiform zones give sometimes very good preparations.

In the medulla, cerebellum, and cerebrum the obtained results are not quite so good; however, I have some preparations in which I have been able to see very clearly the reticulum and very fine stainings of the chromatin, but the results are here much inferior to those obtained by the classical method.

I also have been able to observe that in the nervous centers the difference in results is due to frequent alterations—in the nervous centers of the rabbit by coccodiosis (13).

Now I simply wish to extend my profound gratitude to Dr. Cajal, who, in spite of the many tasks that rest upon his mind, has had the kindness—for which I never can thank him enough—of examining my work and giving me sound and useful advice. I also wish to thank Drs. Wilmer, Callender, Coupal,

and Bitterman, who have so kindly helped me in presenting my research work.

NOTES.

(A) Dr. Urra has also published a method of nitratation applied to sections based on Cajal's and Liesegang's methods. He prepares the colloid medium adding some drops to an argentic solution of 2 per cent. He makes the impregnation and reduction in the vessel. I have not had an opportunity to confirm the results thus obtained.

(B) I have obtained good reactions on specimens which have remained in 70 per cent. alcohol during five months. In general, in the human retina, with short periods from three to four days of impregnation in this liquid, the consecutive nitration of the sections stain first the cones and the external structures of the rods.

(C) As yet, I have not tried other fixating fluids recommended by Cajal, such as chloral-hydrate, veronal, nicotin, ethylamin, sulfonal, thiosinamin, etc., but I suppose that they will be efficient in the technique I am studying.

(D) If with new tests I could determine which is the hypothetical sensitizing substance, much time could be saved by fixing directly in an alcoholic solution of the said body.

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FURTHER NOTE ON BLEPHAROCHALASIS.

By Dr. JONAS S. FRIEDENWALD, Baltimore.

IN a recent article,[1] Dr. F. H. Verhoeff and the writer described the pathological findings in a case of blepharochalasis. The outstanding and previously unrecognized feature of the condition which they noted was the widespread proliferation of the endothelium of the capillaries in the cutis. The author wishes to report briefly a second case which has since then presented itself and which fully confirms the previous observations.

Clinical.[2] B. W., colored, farmer, aged 50, reported to the clinic of the Baltimore Eye, Ear and Throat Charity Hospital on September 21, 1922, complaining of scratching of both eyes. Family and personal history disclosed nothing that might have had a bearing on the local condition. He did not know when his lids began to get heavy, but said that they had been so "for a long time." The scratching had bothered him for an indefinite period, with intervals of comparative comfort. Both upper lids were strikingly baggy. There seemed to be twice as much skin surface as is normally present. The skin was soft and pliable, in no way suggesting œdema; its surface was covered with many fine wrinkles. There seemed to be a deficiency of the subcutaneous connective tissue. The excess skin formed a fold which extended a little below the ciliary margin of the lids and covered the upper half of the pupillary areas of the corneas. The cilia of the outer thirds of the upper lids were turned in, so that they constantly rubbed against the corneas

[1] Archives of Ophthalmology, li., p. 554, 1922.

[2] The writer is indebted to Dr. H. K. Fleck of Baltimore for the clinical note and the tissue examined.

and produced the irritation for which he was seeking relief. The conjunctivæ of both eyes was quite red. Both corneæ showed areas of opacity that did not stain with fluorescin, undoubtedly the result of the trichiasis. The condition was more marked on the left than on the right. Both palpebral fissures were shorter than normal (blepharophimosis). The pupils and fundi were normal.

On October 6th, under local anæsthesia of 1% novocaine, the excess tissue was removed from the left lid and the trichiasis corrected. The patient was discharged from the hospital twelve days later, his condition having been markedly improved. He promised to return for observation and operation on the right eye, but did not return.

PATHOLOGICAL. The tissue was fixed in formalin, imbedded in paraffine. Sections were stained with hæmatoxylin and eosin, and with Wright's elastic tissue stain. The epithelium was of normal depth, but many of the epithelial cells, especially the basal cells, showed marked vacuolization. Interpapillary epithelial downgrowths were present but less numerous than normally found. Except for the changes in the blood vessels, the cutis and sub-cutis appeared normal. There was no decrease in the elastic tissue. Surrounding almost every capillary, there was a sheath of endothelial proliferation containing many new-formed capillary channels.

The pathological picture of this case fully confirms the findings in the case previously reported.

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By Dr. BEN WITT KEY, Secretary.

MEETING OF JANUARY 15, 1923. DR. ELLICE M. ALGER, CHAIRMAN.

The program of the evening was confined to a discussion of the subject of **" the eye in sinus infections."**

Dr. C. W. Cutler presented a paper on the **general considerations** of the eye in sinus infections, which is published in full on pages 331-344.

Special diagnostic methods employed in this study were outlined by Dr. Conrad Berens. A clinical routine for distinguishing abnormalities of the blind spot and the papillomacular bundle were discussed. Also the blind spot for form, motion, light and colors, and the examination factors which cause variation in its size, were considered. Concluding he stated: (1) Size and location for the blind spot varies with the investigator, dependent upon the method employed and the conditions under which he works; therefore each investigator should establish his own standard of the normal. (2) Various factors influence the limits of even the normal blind spot. Careful ophthalmoscopic study of the papilla and peripapillary area is essential in making a diagnosis of pathologic enlargement of the blind spot. Marked daily fluctuations are looked upon with suspicion. Gradual narrowing of its limits for several days in the absence of other signs, leads one to believe the first or former examinations were perhaps in error. (3) In order that the findings may be correctly interpreted, many factors must be considered which require the careful judgment of the ophthalmologist, if serious mistakes are to be avoided.

Dr. GEORGE S. DIXON spoke on the **X-ray diagnosis** of cases of sinus infection, and emphasized especially the impossibility, in many instances, of making a definite diagnosis from the plates alone. The reasons for this were numerated and explained in some detail. He pleaded for closer coöperation and study of the plates in person with the rhinologist and the oculist, in order to arrive at the most reasonable conclusion in these cases.

Dr. L. A. COFFIN, in presenting the **"rhinological point of view"** of sinus infections with ocular complications, said he was especially interested in the first and third cases presented by Dr. Cutler. In the first case he had found no evidence of sinus disease, but stated that such pre-operative lack of evidence does not negative sinus involvement as has been stated by Van der Hoeve. Within the year, the patient had had symptoms of a slight brain hemorrhage, and within three months of the time he had seen her, she had had the grippe with "head stopped up." He instituted treatment for metabolic errors and applied suction to the nose. She improved rapidly until vision was $\frac{11}{11}$. She was dissatisfied because she did not have stereoscopic vision, and intimated that she thought it might have been better had she been operated upon, and that Dr. Cutler was of the same opinion, whereupon Dr. Coffin proceeded to exenterate the ethmoid cells and open the sphenoid. The result was that her vision immediately was reduced to that found at her first visit to him. He has never been able to explain this reduction of vision. While Dr. Cutler thinks the improvement while under the negative pressure may show that sinus disease was present, Dr. Coffin thinks it was due to an improvement in the local circulation of the parts, and more especially is he of this opinion since the autopsy.

He expressed the feeling that thrombo-phlebitis may exist from the ethmoidal to the ophthalmic veins. The nerves may be under pressure from neighborhood swelling of the diseased sinus. Cases spontaneously recover. They recover after operation, also from suction. If what should be comparable to a common denominator in fractions be looked for, Dr. Coffin thought it would be found in the changed circulation of the parts.

The third case of Dr. Cutler interested Dr. Coffin, because he had found many times that cases presenting symptoms pointing to possible sinus disease, which could not be diagnosed from objective findings, recovered entirely when digestion, diet, etc., were carefully corrected.

Dr. Coffin agreed with Dr. Dixon in regard to the unreliability of the X-ray. He not infrequently operated on clinical findings contrary to X-ray findings, and practically always found he had been correct in that judgment. He had had numerous cases referred to him in which the ophthalmologist had reported swellings of from 1 to 6 diopters which had entirely subsided after sinus treatment, or had markedly improved.

DISCUSSION: Dr. E. S. THOMPSON said he was interested in the diagnosing of these cases. Two types of sinus cases cause eye lesions. 1st. The purulent cases—those he had seen were latent ones, there being concealed cells of involvement. The eye frequently showed a cyclitis, a choroiditis or an optic neuritis. Diagnosis is obviously difficult, but when the concealed cells are allowed to drain through evacuation of the area or sinus, the eye condition promptly gets well. The second class of cases—hyperplastic cases—attack the posterior segment. Diagnosis is difficult and must be made by differentiation. The sinus is opened and the eye is relieved. Disease of the bone is the explanation.

Indications for operation are: changes in the blind spots, central scotoma, pallor of the disk, rhinologic examination, X-ray indicative. Dr. Thompson prefers to have the sinus opened without result than to allow the patient to go blind without intra-nasal operation.

He reported a case in which there was color scotoma; vision $=\frac{20}{60}$; optic neuritis; operation and in twenty-four hours thereafter vision $=\frac{20}{15}$. At a later date the same condition returned, vision reduced, optic neuritis; operation and return of $\frac{20}{15}$ vision. For third time this performance was repeated, no pallor of disk and vision returned to $\frac{20}{15}$ for third time. Fourth attack came on while the patient was out West, and vision reduced to $\frac{20}{100}$, fields contracted, and washing out of the sinuses yielded vision of $\frac{20}{15}$. Now at rather frequent intervals the patient has the sinuses irrigated and at this date is free of ocular symptoms.

Dr. FOSTER KENNEDY said that his interest in the relationship of optic nerve injury as a result of sinusitis began in 1907, when a patient, after a minor nasal operation, performed by a general practitioner, became blind in the ipsolateral eye. Her general health after this catastrophe remained good for a year when she died from pneumococcic meningitis of three days' duration; the sphenoidal infection having then burst into the cranial cavity.

Dr. Kennedy discussed the relation of optic neuritis to papillœdema or choked disk; the former being an integral involvement of the nerve with consequent loss of vision. The latter is a mechanical forcing of cerebrospinal fluid into the potential space of the vaginal sheath and its accumulation on the papilla; a process not accompanied by a loss of visual acuity. Following organization, neural compression occurs. In his opinion the number of diopters of swelling at the papilla is no criterion by which to distinguish one process from the other. The processes are completely different, and are to be distinguished by their difference in appearance and different effects on vision, and the widely different visual fields produced in the two conditions.

Dr. Kennedy then discussed cases of retrobulbar neuritis produced by frontal and sub-frontal neoplasms; a local symptom of such growths described by him in 1912. The speaker discussed the different diagnoses of the eye changes in the case of sinusitis and in disseminated sclerosis and encephalitis and aneurysm of the internal carotid artery.

Dr. DUNCAN MACPHERSON referred to two or three features of the subject.

(1) The optic nerve involvements found accompanying intracranial pressure and that found in accessory sinus diseases, are in border line cases so similar that differential diagnosis can not depend on it alone even where choked disks as differentiated from papillitis, etc., are present, because if even a minimum of three diopters is allowed for the definition of a choked disk, that and greater degrees of swelling are found in accessory sinus diseases as well as in intracranial pressure.

(2) Optic nerve œdema has been known in a very few cases to disappear after adenectomy and tonsillectomy. In view of

the number of accessory sinus inflammations clearing after the removal of adenoids and tonsils in children, it is likely that the beneficial effect on the vision, after an adenoid and tonsil operation, is due to the direct action on the sinuses.

The speaker wished to ask of Dr. Berens, what are the indications for blind spot examinations, inasmuch as it is not made as routine in all cases; also whether the data obtained is reliable and whether different chartings are obtained from the same individuals where no cause except that of the patient's individual inaccuracy is known.

Dr. J. J. KING referred to his study of two hundred cases of sinus infection in which the blind spots were enlarged in many of the cases. He reported the case of diplopia in a young girl, whose antrum was badly infected; after opening and irrigating the sinus, diplopia disappeared. The diplopia returned later three times, and was promptly relieved each time by irrigation of the antrum.

The speaker referred to a case of exophthalmos which he had relieved by exenteration of the ethmoid and sphenoid. He also referred to a case of a woman, totally blind in right eye for 24 hours, whose vision returned to $\frac{2}{4}\frac{0}{0}$ after operation; the other eye became totally blind and remained so for some time due to waiting on antiluetic treatment (Wassermann 4+) and without effect; finally operation was performed on the left side and vision rapidly returned to $\frac{2}{4}\frac{0}{0}$.

Dr. W. E. LAMBERT reported the case of a woman with mild œdema of both disks, double retrobulbar neuritis, X-ray negative. Operation, though advised, was not performed; now patient is totally blind, both nerves atrophic. Dr. Lambert believes if operation had been performed, the calamity might have been avoided.

In reply to the question of Dr. Macpherson as to when should examination be made of the blind spot, Dr. Berens stated the following indications:

(1) When vision can not be improved to normal by correcting lenses in the absence of any evident cause.

(2) Where history of headache or nasal trouble, chronically inflamed eyelids or conjunctiva, or congested eyes that do not improve rapidly under treatment, and particularly when there is retrobulbar tenderness.

(3) In dacryocystitis or stenosis of the naso-lacrimal duct, with sinus disease as a probable factor.

(4) In glaucoma or suspected glaucoma, and those with inflammation of the deeper structures of the eye, particularly when the optic nerve is involved.

MEETING OF FEBRUARY 19, 1923. DR. ELLICE M. ALGER, CHAIRMAN.

The major part of the evening was confined to the presentation and discussion of cases illustrating the results of the various **ptosis operations.**

Dr. A. E. DAVIS showed three cases of resection of the lid after the Gillet de Grandmont technique. One of these was a case of unilateral congenital ptosis; one a double ptosis, cicatricial, from trachoma; the third, unilateral cicatricial type. Dr. Davis regards this operation as a safe and satisfactory procedure in any form of ptosis; the technique is simple and the degree of correction is definite.

Dr. C. E. MCDANNALD reported a case operated upon by Machek method modified by Reese which consists in elevating the lid by lateral flaps of sub-cuticular tissue (including palpebral muscle). These flaps swing the lid upward by a central attachment to the tarsal plate, are drawn upward beneath the deep structures of the brow and are sutured to the frontalis fibers just above the brow line. The result can be determined definitely and is entirely corrective.

Dr. L. W. CRIGLER showed a case illustrating the result of the de Grandmont operation.

Dr. J. M. WHEELER presented a case after the Motais technique. The lid was elevated to the position similar to that of the fellow-eye; the lids closed well; motility was undisturbed; no diplopia.

Dr. N. De L. FLETCHER showed the result of a Motais operation.

Two cases, brothers, operated upon the left eye after the Motais method, were presented by Dr. J. H. DUNNINGTON. Both showed the full corrective result of the operation, with no complication.

Dr. I. GOLDSTEIN presented a case of **congenital ptosis** operated upon according to Motais. The result was gratifying.

Dr. B. W. KEY showed two cases of **congenital ptosis, one unilateral, the other bilateral,** and both complete as shown by photographs, operated upon after the Machek-Reese method. In both cases the superior rectus was affected; in one case there was no motility upward. In each case the lid was suspended to the fullest extent; no diplopia.

DISCUSSION: Dr. J. W. WHITE remarked on the usual complication of partial paralysis of the superior rectus in cases of congenital ptosis, in which type of case the Motais operation is contra-indicated.

Dr. A. WIENER prefers the Motais in cases with normal superior rectus; but where the superior rectus is affected he transplants a strip of fascia which is attached to the lid border, inserted under the brow and fixed into the frontalis tendon. He showed a photograph of a result after operation by the latter method.

Dr. H. W. WOOTTON referred to the resection of the levator (Eversbusch) as being a valuable method in certain forms of ptosis, especially those due to thickening or imperfect action of the levator.

Dr. J. M. WHEELER regards the tarsal resection as indicated in small degrees of ptosis. Motais is the best where the superior rectus is normal, and the operation can be performed at an early age. A suture placed at the margin of the lid and brought upward to the brow, thus reinforcing the position of the lid, is an aid in the Motais operation.

Dr. B. W. KEY described briefly the method of suspending the lid by lateral flaps of superficial fascia and palpebral muscle carried directly through broad channels deeply incised beneath the brow and sutured through the frontalis tendon (after the Machek-Reese technique). The method is suitable in any form of ptosis, especially adapted where the superior rectus is affected. It is simple in procedure and rapidly performed; no scar remains; a lid fold can be secured similar to that of the fellow-eye; elevation of the lid is definitely determined and closure of the lids is complete.

Dr. L. W. CRIGLER referred to a case in which he had performed the Machek operation, with subsequent development of a large sebaceous cyst, which it was necessary to remove.

Dr. L. W. CRIGLER presented a paper, entitled **"A simple**

method of treating congenital dacryocystitis." The condition which predisposes to this "postnatal" infection, is congenital in the sense that there has been a delay in nature's process of canalization of the lacrimal passage-ways. This is manifest in 95% of all cases. He reviewed the embryological development of the naso-lacrimal passage-ways, and pointed out that the nasal opening is the last to form; in many instances it is impervious at birth but canalization may continue until nasal mucosa is reached, or the retained secretions, with the aid of muscular action of the lids, cause the thin partition (wall) to rupture. Where no such favorable termination is achieved, so-called "congenital dacryocystitis," is forthcoming.

The author proposes a method of treatment, which he claims is simple and effective. The tear sac is allowed to become fully distended. The surgeon's thumb is placed over the sac in a way to shut off the return flow through the puncta. This is done by placing the thumb sideways, the nail outward, the sides of the thumb pressed against the puncta; now while maintaining pressure the thumb is rotated in the direction of the nasal duct with abrupt pressure against the distended sac. Thus rupture of the retained membrane in the nasal opening takes place. Only one manipulation of this sort is necessary for a cure. Dr. Crigler has employed it repeatedly over a period of seven years, and without a failure to date.

He reviews the literature of the subject, presenting similar and other methods of treating these cases. In conclusion he advocates the method as safe and effective, and especially adapted for use by the pediatrician, the obstetrician and the general practitioner.

DISCUSSION: Dr. H. W. WOOTTON said the method was a very successful one, and that he had not seen a failure.

Dr. J. E. VIRDEN had employed it and had never seen a failure, except in one case in which there was no entrance of the canal into the nose because of the faulty bone development.

A case of **purpura hemorrhagica** with microscopic demonstration of the eye was presented by Dr. MARTIN COHEN (to be published in the ARCHIVES).

Dr. CYRIL BARNERT presented a case of **tuberculosis of the orbit,** also a case of leucosarcomatosis of the orbit (chloroma) (to be published in the ARCHIVES).

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE (LONDON).

By Mr. H. DICKINSON, London.

A meeting of the Section was held on Friday, March 9th under the presidency of Mr. A. L. Whitehead, of Leeds.

Case of Spring Catarrh.

Mr. Cyril Walker (Bristol), brought for diagnosis, the case of a woman aged 37, who presented warty growths on the lids. There was a history of tuberculosis of an elbow extending to 15 years; she had had a series of operations on it, and the sinuses healed two years ago. No disease had been discovered in the lungs. When first seen by Mr. Walker two years ago the warty growths were not so extensive as now. He scraped the nodules, and pathological examination of the material removed showed no evidence of tuberculosis. She was more comfortable after scraping. Sulphate of copper applications seemed to have no influence either way. The fact that a smear revealed marked eosinophilia made him think of spring catarrh, which seemed to be a very uncommon disease in Bristol. He asked as to radium or other radio-active measures.

The President said he would have diagnosed spring catarrh if he had not heard the history, and he would apply radium.

Mr. T. Harrison Butler spoke of three of his cases of spring catarrh which had been treated with radium; two of them did remarkably well, the third not quite so well. He had seen tessellated forms of the disease in the East.

Tumors of Optic Nerve.

Mr. HUMPHREY NEAME read a paper on this subject, supplemented and enforced by an instructive series of slides. It was based upon two cases of the kind he had had under care in the last two years.

The first was that of a boy, who was 14 years of age when first seen. From the age of 8 his mother had noticed that one eye was more prominent than its fellow. It was uncertain from the history whether the proptosis or visual defect was the first to occur. There was a progressive in the proptosis from 1915 until the exhibitor saw him in 1920. The proptosis was a little upwards and inwards. Vision in 1920 was reduced to perception of light. Despite the proptosis, the eye movements remained good. The fundus, disk and macula of the good eye were normal, and vision $\frac{6}{6}$. A nasal examination revealed nothing to account for the proptosis, and a skiagram of the skull did not show any abnormal shadows in the orbital region.

In 1921 Mr. Neame removed the tumor by splitting the external canthus, back to the orbital margin. On blunt dissection, a short piece of optic nerve was found immediately at the back of the eyeball. The tumor was elastic in consistency. The tumor was not completely removed; there was an escape of glairy fluid from the back of the tumor. After the operation, for a few days, there was proptosis caused by hæmorrhage into the orbit; otherwise the after-result was uneventful. Histologically, the optic nerve appeared to be normal. The pial sheath could be traced intact on one side, and almost intact on the other. Outside the pial sheath above there was increased fibrous tissue, and a considerable separation of the dural sheath from the pial; part of the growth had spread through the pial sheath and involved the subdural space.

He referred to Mr. Hudson's paper on this subject, and showed some of the illustrations of it. Mr. Neame discussed the differences between gliomatosis and endothelioma. Of the 118 cases of gliomatosis collected by Mr. Hudson, 70 of the 113 whose sex was stated were in women, 43 in men, and more than 75% of the cases of this condition occurred in the first decade of life. In this condition the visual defect seemed

primary, proptosis being a later development, and eye movements were but little limited. In most of these cases there was either papillœdema or atrophy of the disk. In 50% of the cases removal was incomplete because of extension of the disease into the optic foramen.

The points in the differential diagnosis of endothelioma from gliomatosis were: In the former the age of the patient was greater. In endothelioma exophthalmos generally preceded interference with vision, because the tumor did not primarily invade the nerve, whereas in gliomatosis the nerve was diseased first. Limitation of eye movements was more marked in endothelioma, and there was circulatory obstruction in the lids and conjunctiva. If the media were clear, intraocular extension could be seen.

Mr. TREACHER COLLINS said he found a helpful diagnostic factor was the progressive character of the hypermetropia, owing to the steady growth causing increasing pressure on the back of the globe. He had removed such a growth by the Kronlein operation, and so saved the eyeball. It was best to stitch the lids at the same time, because, the globe being anæsthetic for some time afterwards, there was danger of ulceration. The tumor was cut across at the optic foramen, whence it must have extended into the skull, but no cerebral symptoms resulted, and the child lived many years afterwards, showing that the growth had not a high degree of malignancy. In a future case, instead of a Kronlein he would do the operation Mr. Neame performed in this case; it left less disfigurement. There were three varieties of such growths: gliomatosis, endothelioma, and neuro-fibroma, the differences being due to their originating in different classes of tissue.

Sir JOHN PARSONS objected to the term, in this connection, "neuro-fibromatosis," as it meant an association with nerves. "Fibromatosis" was preferable.

Mr. LESLIE PATON expressed the hope that writers of text-books would cease to use the term "glioma of the retina"; some such name as "neuro-epithelioma" would be better.

Mr. NEAME, in his reply, said he did stitch the lids, and he thought that had a great deal to do with saving the eye.

Mr. WILLIAMSON-NOBLE read a paper on **"Orbital Endothelioma."** He said he had seen two cases of the condition during the last two years.

The first case was that of a girl, aged 15, who was seen by Mr. Levy 12 months ago. The history was, advancement of the right internal rectus, tenotomy of right external rectus in 1913. There was proptosis of the right eye for two months. The movement out and down was very limited, and slightly limited in the upward and inward directions. The pupil was inactive, the disk somewhat pale, and the vision was reduced to perception of fingers at a distance of 4 feet. The eye was enucleated, and the growth removed piecemeal. When portions of the growth were embedded in paraffin, the structure resembled that of carcinoma of the breast. The slide exhibited showed a large amount of fibrous tissue, enclosing spaces containing numbers of large endothelial cells, with round nuclei. The cells showed a tendency to form spaces, a characteristic of endotheliomata; there was also a marked tendency to the formation of whorls. In the large whorls, those which had existed longest, the cells had undergone complete degeneration, showing as a plaque of fibrous tissue. These features brought the tumor into the endothelioma category. This tumor closely invested the optic nerve, and pressed upon it, causing vacuolation of it, as shown in the slide. The tumor seemed to have arisen from the endotheliomatous cells wrapped round the strands of the pia arachnoid.

High magnification showed definite continuity between the endothelioma cells and the endothelial cells on the inner surface of the dura. Still, this appearance might be produced by infiltration from without.

The second case was that of an orbital tumor in a boy aged 3½ years, and he also was under the care of Mr. Levy. There were chemosis, dilated inactive pupil, some swelling of the disk, and proptosis in a forward direction. When the eye was enucleated, the orbit was seen to be occupied by a solid mass. There was much swelling of the nerve head; but the physiological pit was still present. The tumor was received in pieces, and at first it seemed to be of a complex nature: some parts contained bone, some showed apparently normal cartilage, and deeply-stained cells occurred in some parts, less in others.

Some bleeding had occurred into its substance. It seemed to arise from the lacrimal gland, but the gland cells appeared normal, and they seemed to have no neoplastic activity. Sections did not seem to reveal any evidences of involvement of the optic nerve in the growth, nor involvement of dura or pia. The diagnosis seemed to be either sarcoma, teratoma or endothelioma. He inclined to regard it as periosteal chondrosarcoma.

Mr. LEVY said the second of the cases lived six months after the operation; death resulted from intracranial extension of the original growth. No post mortem examination was allowed. He thought the growth had extended from the orbit forwards, rather than conversely. He regarded it as an endothelioma.

Mr. M. S. MAYOU spoke of two cases of the kind which he had had under care. One was a child who had proptosis on one side, and a swelling in the temporal region of the same side. The latter the surgeon took for an abscess, and opened it, and there issued grumous material. When Mr. Mayou was called to the case he said there was a tumor behind the eye, which was so badly proptosed that it had to be removed. The child died in about a month. The tumor consisted of very large cells packed together, with practically no fibrous tissue. It was an endothelioma, and probably started in the orbit. It filled the whole middle fossa of the skull, perforating through the temporal bone, and bulging outside the temporal region.

The other case was in a girl aged 21. He removed the tumor, which was attached to the periosteum, and subsequently the whole orbit was cleared out. The section resembled one of scirrhus of breast. Endotheliomata presented a variety of appearances because of the degeneration so liable to take place in them. Clinically, they all seemed to be very malignant.

Mr. R. AFFLECK GREEVES regarded the second case as a mixed tumor; these sometimes contained cartilage, bone, and epithelial structures, and an arrangement like prickle-cell nests. In the orbit they mostly arose from the vicinity of the lacrimal gland, but not from the gland itself. With this latter statement Mr. Treacher Collins agreed, and said a parallel case was that of tumors near the parotid gland.

Mr. B. CRIDLAND (Wolverhampton) spoke of an extensive case of the kind requiring a severe operation, which was per-

formed by the late Sir Victor Horsley. The boy lived six months after the operation. Mr. Cridland thought that unless the ophthalmic surgeon was prepared to go on and do a large operation, he ought to hold his hand in these cases, and let an experienced cranial surgeon carry it out.

Mr. LESLIE PATON spoke of a case of the kind which he showed 14 years ago, in which various glands became enlarged, finally those of the mediastinum, and the growth was identical in each. It was a clear case of transference of growth along lymphatics, not along the blood stream.

THE PRESIDENT related a recent case of neuroma of the ciliary nerve, which was at first diagnosed as a tumor of the optic nerve. He exhibited the specimen.

REPORT OF THE ANNUAL CONGRESS OF THE OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM

By Mr. H. DICKINSON, London.

The Annual Congress of the Society was held on the 26th, 27th and 28th of April, at the Home of the Royal Society of Medicine and (for the clinical meeting) at the London Hospital. The Chair was occupied by the President for the year, Dr. A. Maitland Ramsay, of Glasgow.

The President's Opening Address.

The President delivered his inaugural address, choosing as his subject the debt which general medicine owes to ophthalmology. He said it was easier for most men to trust in authority than to exercise independent judgment, but the trend of modern progress was to appeal less and less to authority. Specialism was the natural sequel of increase in knowledge, and it should be symbolic of the highest form of efficiency. The tissues of the eye were so delicate, its structure so complicated, its diseases so numerous and so frequently followed by disastrous results that it was no matter for wonderment that oculists had existed from time immemorial, though in quite early days their claim to practise the specialty were very poor, as they had not acquired the general principles of medicine and surgery. The specialist in medicine must combine the diagnostic skill of the physician with the dexterity of the surgeon, and add that special knowledge which gave him power to reach further. It should be the aim of every specialist, by reading and frequent visits to a general hospital, to keep in touch with medicine,

at least along its most important lines of advance. But there should be no hurry, as that might lead to specialization too early, to the cultivation of one department to the exclusion of others. The study of ophthalmology, he contended, constituted the best discipline in exact observation in the whole medical curriculum; it was, indeed, an education in itself, for absolute precision was of the first importance. It was a great aid, too, to a methodical investigation of diseases of the nervous system. Such a purely ocular condition as optic atrophy, ocular palsy, or loss of the pupillary light reflex might lead to the diagnosis of tabes dorsalis. One patient he saw had been blind from optic atrophy twenty years before the onset of the more widespread manifestations of disease of the spinal cord. Likewise the study gave decisive evidence of disease of brain or kidneys. Homonymous hemianopsia might be the only proof remaining of a past cerebral hemorrhage, and its recognition where paresis had been slight and transient would prevent the physician falling into error, either in regard to diagnosis or prognosis.

On account of the transparency of its structures, the eye had always been the hunting-ground of the pathologist; pathological changes usually hidden from view could be seen and watched in the eye from day to day.

For some years he had been working with Sir James Mackenzie to whose teaching he owed a great deal of inspiration. He had been struck by the similarity of action of ciliary muscle and cardiac muscle. In both, the limits of muscular capacity must be respected, and the amount of work to be done should be adjusted accordingly. Of all the unstriped muscles in the body, it was only the ciliary muscle and the cardiac muscle which could be forced by the will to continue working long after Nature had called for rest, and the former of these was active all through the waking hours, and the latter was incessant. The reserve power of both became less as age advanced. Loss of power in the eye could be measured and glasses prescribed accordingly; but in the case of the heart which was using up its reserve all that could be done was to limit its work in accordance with its capacity. The power of accommodation could be regarded as a fair index to the general health. In emmetropes who were robust, the need for spec-

tacles could be delayed beyond the usual age, just as the heart of some elderly people permitted them to play strenuous games; but in them the rapid onset of presbyopia was always a sign of failing health, and that the person was not likely to live much longer. Adults often complained of their eyes after influenza, and children often suffered from their eyes for the first time after measles or scarlet fever; in fact sight was quickly affected in all disorders of the body. Inability to use the eyes for close work on account of excessive pain, with hyperalgesia of the skin of the scalp, were symptoms in every way comparable with those present in angina pectoris. The acute symptoms might not be manifest until some hours after the causal effort.

In conclusion, he said the gain to scientific medicine would indeed be great when the ophthalmologist coöperated closely with the family doctor and kept himself informed of the subsequent medical history of patients who had consulted him on account of failing sight, and when, on the other hand, the general practitioner brought his medical knowledge, experience and common sense to bear on all the ophthalmological problems with which he might be confronted in his work.

The Ætiology of Angeoid Streaks in the Fundus Oculi.

Mr. E. TREACHER COLLINS read a paper on this subject. He said a comparison of the arrangement of these streaks in the different recorded cases showed that they presented certain common characteristics, which could only be accounted for by there being some anatomical factor upon which their distribution depended. Their arrangement, he showed, corresponded closely to that of the circle of Zinn of the short posterior ciliary arteries around the optic disk, and of the main branches proceeding from it. Ophthalmoscopic observations by several different writers showed the undoubted hemorrhagic origin of these streaks. The hemorrhages from which they had been seen to arise were never situated in front of the retinal vessels, nor were they flame-shaped like retinal hemorrhages, but presented the characteristics of sub-choroidal or inter-choroidal hemorrhages. Blood effused between the choroid and sclerotic, due to its slow absorption, would, like blood stagnant

in other parts of the body, tend to give rise to insoluble crystals of hæmatoidin and hæmosiderin. These, if deposited in the perivascular spaces around the branches of the short ciliary arteries, would account for their pigmented appearance when viewed ophthalmoscopically.

The other fundus changes commonly met with in association with angeoid streaks, such as haze or pigmentation of the retina, various degrees of atrophy of the choroid, etc., were also, he said, adequately explained as the outcome of sub-choroidal hemorrhage. There was not yet sufficient evidence as to why patients suffering from this affection should have choroidal hemorrhages.

Consecutive Cases of Cataract Extraction by Barraquer's Method.

Mr. R. AFFLECK GREEVES and Mr. R. FOSTER MOORE read separate and independent papers on this subject.

Mr. GREEVES' contribution was based on 49 patients from whom he removed, or attempted to remove, the lenses by Barraquer's method. In two cases he removed the lens from each eye, making the total number of lenses 51. The cases he divided into three groups. In group 1, 31 cases, the lens was successfully extracted in its capsule. In group 2, 7 cases, the capsule broke during the operation, but he was able to extract the greater part of the lens substance with the suction instrument, the capsule left behind being subsequently needled in the usual way. In the third group, 13 cases, the lens could not be delivered by the suction instrument, and the use of the scoop was necessary.

The cases in the second group mostly ran the same course as those after extraction by the old method, and in each case the secondary cataract was needled. In one, needling was a failure, and he proposed to perform iridotomy.

In all the 13 cases in the third group a scoop was used. In the majority, very little vitreous was lost, and on the whole he did not regard the visual results as unsatisfactory. The smallness of the vitreous loss was probably due to the lens being already dislocated forwards. In one case the cataract was hyper-mature and the zonule weak. If a complete iri-

dectomy had been done, the corner of the coloboma might become caught in the edge of the cup and prevent extraction. Another possible reason was the giving way of the lens capsule after the lens was dislocated. A further cause for failure was an unknown variability in the negative pressure obtainable due to the changes in strength of the electrical current which actuated the motor. He entered into the technique of the operation, and gave particulars of each of the 51 lenses treated.

In conclusion, he said his view was that the result of a successful intracapsular extraction by this method left nothing to be desired. The pupil was black and free of membrane, the media were clear, the visual acuity was excellent, and there was no undue amount of astigmatism On the other hand, however, the method had shown itself to be less certain in its results than extraction without the capsule.

Mr. R. FOSTER MOORE'S paper was based on 38 cases; he had excluded 6 in which he operated with an improvised method of producing the vacuum before the Barraquer apparatus was available. Concurrently with doing this operation at Moorfields, he had been, at St. Bartholomew's Hospital and in private, carrying out the extra-capsular method; and this enabled him the better to judge of the respective merits of the procedures. He described a modification of Barraquer's instrument which he had been using; this enabled more delicate manipulation to be carried out, and had no valve which could get out of order. His chief difficulty had arisen from the separation of the cup from the lens when traction had been applied, so that in some cases the instrument had to be reapplied a number of times. Sometimes rupture of the capsule had ensued, sometimes recourse had to be had to the cystotome or scoop. He was sure some of the difficulties had been due to defective suction; in the earlier cases it was not appreciated how poor the suction was. In the latest Barraquer instrument a manometer was incorporated—a great gain.

Of the 38 cases, 22 could be said to have had a quite successful result, the lens being removed entire in its capsule, and there were no difficulties or complications at the time. In 5 others the lens was removed in its capsule, but there was some loss of vitreous. Thus there were 11 cases in which he failed to remove the lens with the instrument, and other means of

doing so had to be resorted to. In 7 cases the lens was expressed after either rupture of the capsule by the instrument, or after cystotomy; and in 4 cases the scoop had to be resorted to. In 9 cases in the series there was loss of vitreous. In one, suppuration occurred and evisceration was performed. In every other case some useful vision at least resulted.

He proceeded to discuss the advantages and disadvantages of the method. Among the advantages was that the whole capsule was removed with the lens, tags of it could not become incarcerated in the incision, and, further, no secondary needling operation was necessary. An important advantage, also, was absence of post-operative iritis. And it was gratifying to see an uniform black pupil after the operation.

The outstanding disadvantage of the method was the frequency of vitreous loss, and its consequences. When such loss occurred he did not doubt that the prognosis, both immediate and remote was worse than when there was no such loss. In 23.7% of his cases there was loss of vitreous. And a very important result was, that the welling of the vitreous into the wound carried the pillars of the iris into the incision, and a deliberate attempt to replace them resulted in further loss. And should any secondary operation be needed in the first day or two, the risk of vitreous again became important. The danger, however, was much minimized by paralyzing the orbicularis with novocaine. In Barraquer's method the lens was drawn out of the eye, not expressed from it; therefore a slight negative pressure was developed within the globe, so that the vitreous tended to suck back rather than to follow the lens, and this might render loss of vitreous more frequent than would otherwise be the case. And in many cases there was need for a complete iridectomy. Altogether, he considered that the operation had in it a considerable element of danger, especially in the matter of vitreous loss, so that for general use it was inferior to the older method. But for immature cataracts and sclerosed lenses the Barraquer method had distinct advantages of its own.

Mr. MALCOLM HEPBURN pointed out that the success of this operation depended largely on an instrument rather than on personal skill. The weight of the instrument, he considered, tended to hamper the necessary delicacy of manipulation.

Mr. LESLIE PATON was not greatly impressed by the instrument.

Col. H. SMITH, I. M. S., said his long experience led him to urge that secondary operations should be deferred until after 10 days. In the intracapsular extraction there was more liability to prolapse of the iris. He could not be sure whether or not the vitreous was renewed in cases in which there had been a loss of it at the cataract operation. He emphasized the great need of thorough control of the orbicularis while the operator was at work.

Mr. KIRKPATRICK also spoke, and the authors replied.

Mr. D. V. GIRI contributed a paper on **"Intracapsular Extraction of Cataract, with a Description of a Simple Technique."** It was based on 384 cataract operations he did at Bikaner, Rajputana, India. He had to resort to the intracapsular operation because his patients came long distances, were very poor, and time was of great value to them. One patient became so restless after the incision, and rolled his eye so much, that the operation could not be done step by step; hence the operation had to be done speedily, and he therefore expressed the lens in its capsule. Very little pressure was needed, and it came away without mishap. After that, he proceeded to deliberately take out the cataract *in toto*. He described his procedure. The lids were best held apart and controlled by an assistant throughout the operation. For immature and intumescent cataracts the intracapsular was, he said, the operation *par excellence*. If capsulectomy was properly done, the mature hard cataracts shelled out easily as a whole. In a large percentage of mature and hard cataracts the capsulectomy operation gave results which compared favorably with the intracapsular. The worst cataracts to deal with were the hypermature and complicated. The paper entered into every step of the procedure with particular minuteness, and contained a comparison with other procedures.

Disorders of the Blood and their Ophthalmological Manifestations.

A discussion on this subject was held on Friday. Sir HUMPHRY ROLLESTON, in opening the discussion, said that

whereas patients with renal disease, arterio-sclerosis, or affections of the central nervous system might first seek medical advice on account of ocular symptoms, and a diagnosis of underlying general disease might be made from the local changes, such was rarely the case in disorders of the blood. The disorders which he discussed were as follows: erythræmia, pernicious anæmia, subacute combined degeneration of the spinal cord, aplastic anæmia, chlorosis, secondary anæmia (post-hemorrhagic), splenic anæmia of adults and of infants, leukæmia (with chloroma), scurvy, purpura, hæmophilia. The underlying cause of erythræmia was still a matter for further research, possibly it might prove to be a syndrome due to various causes. The frequency of ocular manifestations in it was as yet indeterminate. The visual disorders were variable, and could not be solely explained by the appearance of the fundus. In pernicious anæmia small retinal hemorrhages were usually present; according to Cabot they occurred in over 70%, and they were said to be seen when the red cells fell to 25% of the normal. In subacute combined degeneration of the cord the ocular manifestations were mainly those of anæmia—dimness of vision and pallor of the disk; also slight papilloedema. There might be sluggishness, small size and irregularity of the pupils, and nystagmus owing to degeneration in the cervical cord. Retinal hemorrhages and neuroretinitis might occur in aplastic anæmia. In som of the cases of this now rare disease there was permanent impairment of vision. In severe secondary anæmia, hemorrhages into the retina were very common, and this was probably chiefly due to the underlying toxæmia. In the chronic splenic anæmia of adults he did not know of any special changes in the fundus. In the splenic anæmia of infants (Von Jaksch's anæmia pseudoleukæmia infantum) retinal hemorrhages probably occurred, but he could not state with what frequency. In Gaucher's disease the conjunctivæ showed a wedge-shaped thickening of brownish-yellow color, with its base to the cornea, first appearing on the nasal side of each eye. Moore described three stages in the retinal changes accompanying leukæmia; (1) engorgement of the vessels, chiefly the veins. 2) The previous engorgement was accompanied by hemorrhages having a central white spot, due to leucocytic accumulation. (3) A general

leucocytic infiltration of the retinæ and choroid, causing thickening. Contraction of visual fields and night-blindness might also result in this disease. The visual symptoms were not of diagnostic importance in scurvy. Infantile scurvy might show petechiæ of the eyelids. In purpura, flame-shaped hemorrhages into the nerve-fiber layer of the retina were not uncommon, according to Foster Moore. In hæmophilia the retinæ may be free from hemorrhages.

Sir FREDERICK ANDREWES, F. R. S., spoke on the pathology of disorders of the blood in relation to the eye. Functional disturbances of vision did not need much attention. When through heart failure or thrombosis the blood supply to the retina was cut off or seriously reduced, vision might fail. In ordinary syncope temporary failure of sight might occur without structural change. Yet vision did not appear to fail in even the extreme degrees of pernicious anæmia; only in the post-hemorrhagic form of anæmia did temporary blindness sometimes occur. Yet vision was commonly affected in the converse condition, erythræmia, in which the red cells and the total volume of blood were increased. Visible changes in the fundus took place as vascular alterations in blood conditions, and nowhere could the changes be so well studied. He believed that in chlorosis there was an increase in the fluid elements of the blood, and this was the only form of anæmia in which papillœdema had been observed to occur. He discussed œdema, extravasation of leucocytes, escape of red corpuscles, and leukæmia, remarking that it was possible the retinal hemorrhages in the last-named depended in part on a weakening of the capillary wall from the emigration of leucocytes. He also entered into a minute consideration of the function of the blood platelets.

Dr. A. J. BALLANTYNE said that more than 50% of the cases of anæmia and leukæmia he saw in nine years showed fundus changes of some kind, including alterations of the caliber, course and color of the vessels, œdema of the retina, retinal hemorrhages, and retinal exudates. In simple anæmias there was a tendency to broadening of both arteries and veins, also to an abnormal tortuosity. Pallor of the disks was often visible, but notable pallor of the fundi was exceptional. Hemorrhages were never found in the retina when the hæmo-

globin was higher than 35%. Often the hemorrhages and exudates cleared up when the patient was at rest in bed.

Mr. R. R. JAMES also took part in the discussion. He said he had not seen fundus changes in chlorosis. He detailed the blood picture found in the various classes of cases he had examined during a period of 14 ears' hospital observation.

The Bowman Lecture was delivered by Professor GEORGE E. DE SCHWEINITZ (President of the American Medical Association) on **"Certain Ocular Aspects of Pituitary Body Disorders, Mainly Exclusive of the Usual Central and Peripheral Hemiopic Field Defects."**

Discussion on "The Diagnostic Significance of Proptosis."

Mr. WILFRED TROTTER introduced this subject. He said diagnosis was still essentially a clinical procedure carried out in the face of experience presented to the medical man unselected and at random. He intended to present in this paper only material which came directly within his own knowledge, restricting his consideration to the grosser forms of proptosis.

A broad division of cases could be made according to whether the eye was displaced antero-posteriorly alone, or whether the antero-posterior projection was combined with some other displacement. The first of these depended on swelling of the orbital tissues from inflammatory conditions or circulatory disturbance, the others, to encroachment upon the orbital space by a swelling—generally a neoplasm—originating within or without it. The general surgeon mostly saw the first group in connection with traumatic orbital hemorrhage, thrombosis of the cavernous sinus, arteriovenous aneurysm within the skull, and Graves' disease. These he considered in detail.

In the second group the cause at work was a swelling originating within or encroaching upon the orbit. The great point to determine was whether or not the cause was a malignant tumor. It usually was so when the eye was displaced forward and also in the coronal plane. Such benign conditions, however, as mucocele of the accessory sinuses, exostosis of skull and benign nasal growths, could cause it. Malignant growths could be divided into those invading the orbit according to

their place of origin, into those of ethmoid, sphenoid, and maxillary regions. Growths of the ethmoid and maxillary regions produced marked and early displacement in the coronal plane, growths of the sphenoid region tended to produce a downward and lateral displacement, at a later stage. All these forms of malignant disease were of insidious onset, and often when their true nature was recognized they were beyond the hopeful reach of surgery. Growths of the ethmoid region were usually recognized by the rhinologist, in whose domain they came. Sometimes their course could be definitely delayed by operations which, at the time, appeared to be very unpromising. Growths in the sphenoidal region presented the greatest difficulties in early diagnosis; they were usually endotheliomata or sarcomata of the periosteal type. Sometimes they might be slowly developing for several years before causing unmistakable symptoms. He related a very interesting and instructive case.

Mr. J. H. FISHER devoted his contribution to a general review of the subject. The term "proptosis" directed attention to something retro-ocular which was propelling the eye forward, or, more correctly, a falling forward of the eye because it was imperfectly restrained in its orbit by muscles. The prominent eyes of very obese persons occasionally brought them within the title, and he had had to perform tarsorrhaphy for this condition; this possibility should be kept in mind in diagnosis. Foster Moore had found fat in the orbit in Graves' disease to be in an abnormal condition; but Treacher Collins considered that Müller's muscle caused the condition, regarding it as the analogue of the "protrusio bulbi" muscle of lower animals. The proptosis in Graves' disease was not always symmetrical, nor of synchronous onset in both eyes. In both this disease and orbital tumors X-rays were often of but little value. As removal of optic nerve tumor, whether with or without resection of the outer orbital wall, rarely left a passable cosmetic result, he strongly advised removal of the blind eye with the growth in every instance. Traumatic exophthalmia would depend on the presence of a foreign body lodged in the orbit, or the pressure of extravasated blood, or infiltration of the tissues with air through the fractured walls of the orbit from the nose or some of its accessory sinuses.

Hemorrhage into the orbit might occur without accident, such as in children suffering from whooping cough or scurvy, in hæmophilics, and in later years of life attributable to arteriosclerosis. Cysts following hemorrhage had been described. Congenital dermoid was the most frequent cyst of the orbit; others included hydatid and cysticercus, but these could only be proved by examination after operation. Cellulitis and infective osteitis of the orbit were easy to diagnose. In all cases of proptosis with inflammatory manifestations examination should be made for paralysis of any of the nerves running in the floor or outer wall of the cavernous sinus. Vascular tumors of the orbit with proptosis must be differentiated into pulsatile and non-pulsatile, the latter being mostly cavernous angiomata. He advocated association with the neurologist in dealing with intracranial causes of proptosis; these he dealt with seriatim. Similarly, in cases of extension of growths from the accessory sinuses of the nose, the assistance of the rhinologist might be needed in dealing with the septic conditions in those cavities. The rhinologist invoked the aid of the radiologist, but both together often gave the ophthalmologist less assistance than he needed.

Dr. ANGUS MACGILLIVRAY followed Mr. Fisher. He said the apex of the cornea was between 12 and 14*mm* in front of the temporal margin of the bony orbits; when readings of over 14*mm* were taken, exophthalmos was present, when under 12*mm* enophthalmos. The routine use of the exophthalmometer was desirable. Proptosis due to increase in the orbital contents was the result of certain inflammatory, pathological, or traumatic conditions originating in the orbital cavity, such as periostitis, cellulitis, neoplasms, vascular derangements, and thickening of orbital walls. These were the main conditions causing proptosis which the ophthalmic surgeon was likely to be called upon to treat. He divided proptosis, for diagnostic purposes, into (a) bilateral and (b) unilateral, the first being much the smaller division. He discussed them at length, and said, in conclusion, that after 28 years of experience in the ophthalmic department of a large general hospital, he and his colleagues had come to regard proptosis as a danger-signal, and the help of colleagues in other departments was sought without delay in arriving at a cause.

Mr. P. G. DOYNE also read a contribution on the subject.

Mr. ROPER, Mr. JOHNSON TAYLOR, Mr. HARRISON BUTLER, Mr. MAYOU, Mr. TRAQUAIR, Mr. INGLIS POLLOCK, Mr. BEATSON HIRD, Mr. HEALEY, Mr. B. CRIDLAND, Mr. GREEN (Norwich), and Mr. R. FOSTER MOORE took part in the discussion, and the openers replied.

Mr. W. T. HOLMES SPICER read a paper on **"Secondary Corneal Opacities."**

Mr. F. A. WILLIAMSON-NOBLE read a paper on **"Macular Changes Associated With Thrombosis of the Central Retinal Vein."** He described the appearances in four cases. These are indicated in the following details of the first case. The sight of the patient, who was aged 27, had been failing 18 months before excision of the eye. There was old interstitial keratitis, the cornea being opaque and ectatic. He showed micro-photographs of the sections cut at different angles. It showed the usual picture in venous thrombosis, and the thrombosis had occurred in the region of the lamina. Sections of the half-eye showed vascularization of the middle and deeper layers of the cornea, and hemorrhage in the nerve fiber layer of the retina. There was slight œdema in the external molecular layer of the macular and perimacular region. He concluded (1) that in cases of thrombosis of the central retinal vein, a varying degree of œdema developed in the region surrounding the fovea, causing damage to retinal structures here. (2) That if œdema were of old standing or large in amount, some of the fluid percolated through the subretinal space, caused detachment of retina in the macular region, bringing about its degeneration.

Members attended the London Hospital on Friday afternoon, where a series of cases were inspected and discussed.

On Friday evening, a number of papers were read. One was contributed by Mr. F. A. Ross and Dr. SHEPHEARD-WALWYN on **"A Case of Mikulicz's Disease."** It was illustrated by photographs. The patient was a married woman, aged 37. The bulging below the eyebrow was found to be due to a finely-nodular enlarged lacrimal gland. There were the usual symptoms and physical characteristics of the disease. The urine was normal, and the Wassermann negative. Immediately preceding death she had air-hunger, cyanosis, and

œdema of both lungs, the physical cause of death being acute nephritis and uræmia. The tubules of the lacrimal gland, according to Dr. Canti's report, were normal, but were pressed apart by masses of round cells containing a few fibroblasts and fibrous tissue cells. The various treatments tried, and the clinical course were carefully set forth.

Mr. B. T. LANG discussed the subject of **" The Unobstructed Field in Perimetry,"** Mr. JOHN ROWAN presented a paper on **" A Case of Intraocular Tumor, Presenting Some Unusual Features,"** and Mr. G. F. ALEXANDER spoke on **" Measurement of the Diameters of the Cornea and Pupil and the Inter-Pupillary Distance."**

Mr. ANGUS MACGILLIVRAY read a paper on **" Enucleation of the Eyeball Under Local Anæsthesia."** He pointed out that the services of the expert anæsthetist were not always available, and in his absence the administration might be indifferent. In the search for a suitable local anæsthetic, a 2% novocaine solution was fixed upon, owing to its comparatively low toxic properties, and in practice their confidence in it had increased. The solution consisted as follows:

Novocaine 10 grs.; sodii chlorid 2 grs., Potass. sulph. 1½ gr.; Aq. distill 1 ℥. It should be kept in a stoppered bottle, and could be sterilized more than once without deterioration if adrenalin were not added. He described the procedure in detail. It was not necessary to prepare the patient as for general anæsthesia. To neurotic or frightened patients, two 5 gr. doses of veronal were given the previous day, *i.e.*, at 5 and 10 P.M. The method could be easily adapted to all forms of extraocular operations. He believed that when once the details of the method of securing local anæsthesia had been properly grasped, it would become the routine, general anæsthetics being reserved for young children.

Mr. BASIL GRAVES (who is Lang Clinical Research Scholar at Moorfields, and Pathological Curator at the Royal Westminster Ophthalmic Hospital) read a thoughtful paper on **" Microscopy of the Living Eye."** He described, with the aid of diagrams projected with the epidiascope, the main principles of illumination of the eye, and discussed the selection of a suitable nomenclature for certain conceptions which, arising out of this new work, at present lack suitable definitive terms.

He felt that a vague, equivocal or unjustified use of certain terms is creeping into the English-written literature of this subject. Such terms as diffraction, fluorescence, scattering, internal refraction have a very precise significance in the nomenclature of the physics of light, and he suggested that for the present the unsubstantiated appropriation of such terms for various clinical effects is apt to lead to confusion among writers, and is wanting in scientific accuracy. He pointed out that a speculative use of such terms was furthermore unnecessary, because for the moment we are concerned more with the making use of results than with the explaining of their cause. He suggested certain non-committal terms to indicate various effects, which he explained by diagrams, among them the word "relucency" for that property of a transparent living tissue in virtue of which a beam of light traversing it undergoes modification, to be revealed as a manifest illumination of the tissue. He pointed out how in the ordinary method of oblique illumination with a pocket lens and a widespread light source, the view of deeper structures was not clear because of illumination occurring in those transparent tissues which are in the line of observation. As instancing, however, what was possible by means of the ordinary method in the hands of a skilled observer, he quoted the detection of the finer cases of Mr. A. C. Hudson's "brown line" in the cornea.

After referring to the principle of diaphragm-lamps, such as those of Gullstrand, Lemoine and Valois, he demonstrated a hand-torch (not on the diaphragm principle) to give an intense beam 4*mm* in diameter, for use in clinical inspection of the eye with the pocket loupe, or in such operations as needling, with the aid of which the operator could clearly see the membrane to be needled by observation through tissue whose transparency is not impaired by aberrant rays of light. He illustrated the four main headings under which could be grouped the methods of illumination for microscopy of the eye, and as a substitute for vague and multiple terms at present in use for three of these, he suggested the adoption of terms which he is accustomed to use in his own notes: "Direct-illumination," "Retro-illumination," "Proximal-illumination." The fourth method, elaborated by Professor Vogt, he designated "Specular

reflection." He then gave, by diagram, examples of the manner in which different physical conditions could operate in these main methods.

He went on to discuss the Zeiss binocular microscope, an instrument which has been made in its present highly efficient form for many years. He suggested that this instrument had not previously been adopted more generally by ophthalmologists chiefly for two reasons: (1) its scope would have been better indicated if it had been named the binocular eye microscope instead of the corneal microscope; and it had always been provided with an attached automatically registering illuminator which lacks sufficient intensity in its light source, and whose optical design is unsound for the purpose required of it, because it yields a beam of light very wide in diameter. He had no wish to detract from the great value of a special focal illuminator such as the slit-lamp; but as a preliminary or adjunct to the use of this, some illuminator attached to the microscope, giving a wider yet still restricted beam, and in automatic registration with the focussing of the microscope, was, he contended, very desirable in routine work on microscopy of the eye. He described how possessors of the Zeiss eye microscope can themselves, at a very small cost, alter the optical system of the illuminator, so that it will yield an intense focal illumination of about 4 to 5 millimeters in diameter. With this it is possible to get a very clear view under high power of the blood corpuscles moving in the corneal channels of an old case of interstitial keratitis. In more advanced work, e.g. in Vogt's method of using the slit-lamp by observing the endothelial corneal surface by reflection, in which only a very small area is illuminated and the visual background is dark, Mr. Graves prefers on occasions to facilitate the location of certain features by illuminating the background with light introduced from such an additional second source. He pointed out that the Lucanus quadrant was better than the alternative Gullstrand semi-circular rail as a mount for this illuminator, because it so happens that the pivoting of the illuminator to the quadrant by a movable joint enables the focussed light to be swung at will to and fro across the field of observation. This, with the alterations described, gives excellent facility for quick, simple inspection of the eye under circumscribed focal

illumination, without a veiling of the view of structures on a deeper plane resulting from illumination of those more superficial tissues through which observation must be made.

The reader of the paper urged the adoption of so-called microscopy of the eye in routine practice, as being an easy and precise means of fine observation. He added that if the principles sounded somewhat complicated, they were not so in practice, and he offered to show, at the Moorfields Eye Hospital, the application of the various apparatus.

There were also read the following: Mr. HUMPHREY WEANE, **"Results of Further Investigations on the Passage of Arsenic into the Aqueous Humor after Intravenous Injection of Novarsenobenzol in Rabbits,"** Mr. W. B. INGLIS POLLOCK, **"A Case of Pseudo-Glioma,"** and Mr. G. F. ALEXANDER, **"A Theorem Generalizing the Optical Problems of Ophthalmoscopy and Skiascopy."**

A museum of instruments and appliances was held during the Congress in the Royal Society of Medicine's Marcus Beck Laboratory. On Thursday evening, members dined together, and the Congress was in every way an unqualified success.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY.

Abstracts by DRS. A. N. ALLING, New Haven; M. J. SCHOENBERG, New York; T. H. BUTLER, London; P. G. DOYNE, London; and K. WESSELY (*Archiv für Augenheilkunde*), Würzburg.

Edited by MATTHIAS LANCKTON FOSTER, M.D., F.A.C.S., New Rochelle, N. Y.

(*Continued from the May issue.*)

VIII. THE ORBITS AND ACCESSORY SINUSES.

55. EICKEN. **Accessory sinuses and diseases of the optic nerve.** *Zentralbl. d. ges. Ophthalm.*, iv., p. 49.

56. ERGGELET. **Bone tumor of the left orbit.** *Münch. med. Wochenschrift.*

57. HUBER. **A case of inflammatory pseudotumor of the orbit.** *Klin. Monatsbl. f. Augenheilkunde*, lxv., p. 718.

58. SCHAEFFER, J. P. **The visual pathway and the paranasal sinuses.** *American Journal of Ophthalmology*, February, 1922.

ERGGELET (56, **Bony tumor of the orbit**) describes a case of exophthalmos forward and downward in which a smooth tumor as hard as bone could be felt in the upper inner part of the orbit. The mobility of the eyeball is said to have been normal. The X-ray showed a shadow in the region of the ethmoid cells and sphenoid with an extension toward the temporal margin of the roof of the orbit. The vision was good, the papilla somewhat pale. Wassermann negative. Diagnosis: osteoma of the ethmoid cells. Confirmed by operation. Uneventful recovery.

HUBER (57, **Inflammatory pseudotumor of the orbit**) reports the following case. A man 20 years old, a prisoner for eleven months, was suddenly seized with blindness and severe pain in his left eye. Examination showed amaurosis of the

left eye, which protruded outward and downward with paresis of the extrinsic muscles. The orbicularis was intact. The ophthalmoscope revealed a marked choked disk, no hemorrhages, and a slight peripapillary œdema. The patient had tuberculosis. Wassermann, X-ray, and nasal examinations gave negative results. No benefit from potassic iodide. The presence of a sarcoma was suspected, so the orbit was exenterated. Microscopic examination revealed a chronic retrobulbar inflammation. Plasma cells and lymphocytes, the latter frequently as lymph follicles, were found in the connective tissue of the orbit, which was poor in vessels and cells. The musculature was swollen with hyalin. The connective tissue between the muscle fibers was increased and contained little infiltrates of lymphocytes and plasma cells. The papilla and choroid were œdematous. Seven weeks after the exenteration the patient complained of headache on the right side. The right eye showed a hyperæmia of the papilla, and a difference of refraction between the papilla and macula of four diopters. Vision good. Energetic treatment with mercury and iodide was instituted and the condition did not grow worse. Further course unknown.

EICKEN (55, **Accessory sinuses and diseases of the optic nerve**) criticizes sharply the enthusiasm for endonasal treatment of the accessory sinuses for diseases of the optic nerve. A review of the literature shows that the diagnosis of rhinogenous retrobulbar neuritis is frequently made from very different bases. To all appearance many cases have been ascribed to a rhinogenous origin when improvement has followed an endonasal intervention although no pathological findings could be demonstrated. There have been cases in which the patients operated on later developed a multiple sclerosis as the cause of the disease. Taking into account the uncertainty of the diagnosis Eicken thinks the rhinologist not justified in performing an operation at the request of the ophthalmologist. The views of rhinologists vary concerning the effect of endonasal treatment upon such neuritis. Many cases are cured by slight interventions, like the application of cocaine. Cleansing of the antrum often brings betterment. Others recover after slight operations on the turbinates. Numerous cases are reported in which the opening of the posterior ethmoid and the sphenoid

cells was effective. Very often no pathological condition was revealed by these operations. Because of the lack of pathological studies we are still far from a correct knowledge of all the ætiological factors.

SCHAEFFER'S (58, **The visual pathway and the paranasal sinuses**) interesting paper is the result of a careful study of the relation of the optic nerve and chiasm to the posterior ethmoid and the sphenoid sinuses. One is struck by the fact that a very great variation exists in different skulls and also between the two sides of the same specimen. As a rule it may be said that the optic nerve is in close relation to the sinuses for about 21*mm* to 26*mm* of its length, and in many cases the contact is so close that the optic canal forms a mound in the wall of the sinus; as the bony walls of the ethmoid and sphenoid sinuses are extremely thin, and sometimes even absent, so that only the mucous membrane intervenes, it is not strange that disease of the sinuses should be communicated to the nerve. The ostium of the sphenoid sinus is situated at some height above the floor, and this is sometimes true of the ethmoid, so that drainage is not easily effected, thus adding to the dangers. The optic nerve within the orbit is for the most part separated from the sinuses by orbital fat, and the optic commissure may be protected from the ethmoidal sinus either by thick walls or by the hypophysis, so that these portions of the optic tract are less liable to involvement. The infection may be carried either through the lymph channels or through the blood. ALLING.

IX.—THE CONJUNCTIVA.

59. BLATT. **Clinical and experimental studies of parenteral milk injections in trachoma.** *Klin. Monatsbl. f. Augenheilkunde*, lxv., p. 668.

60. BRAUNSCHWEIG. **Formation of folds in the conjunctiva bulbi.** *Ibid.*, lxvi., p. 123.

61. CORDS. **Treatment of vernal conjunctivitis.** *Ibid.*, lxvi., p. 470.

62. GUIST. **A case of Recklinghausen's disease with involvement of the lids and bulbar conjunctiva.** *Ibid.*, lxv., p. 850.

63. KIEHLE, F. A. **Phlegmon of the conjunctiva following operation.** *American Journal of Ophthalmology*, December, 1921.

64. KUBIK. **Spirochætal conjunctivitis in infants with congenital syphilis.** *Klin. Monatsbl. f. Augenheilkunde*, lxvi., p. 69.

65. LINDNER. **An endemic of 56 cases of gonorrheal conjunctivitis.** *Ibid.*, lxv., p. 637.

66. SCHREIBER. **Formation of folds of the bulbar conjunctiva and its relation to blepharochalasis.** *Ibid.*, lxvi, p. 440.

LINDNER (65, **Endemic of gonorrheal conjunctivitis**) reports a peculiar endemic of gonorrheal conjunctivitis which occurred during the war, by which fifty-six soldiers were laid up. Only two of them had a subacute urethral gonorrhea. The source of infection was finally traced to the soiled fingers of an attendant, who everted the lids for the routine inspection of the eyes.

BLATT (59, **Parenteral milk injections in trachoma**) studied the effects of this treatment on 150 patients with trachoma, divided into groups of 50 each. In the first group milk injections alone were employed; the results were 22 worse, 28 unchanged, no case of improvement. In the second group local treatment was combined with milk injections; the results were 3 worse, 16 unchanged, 31 improved. In the third group local treatment alone was employed and no milk injections given; the results were 4 worse, 12 unchanged, 34 improved.

Although fibroma of the lids has been frequently observed as a concomitant with a general fibromatosis, such an involvement of both the lid and the bulbar conjunctiva is rare, and this makes the case of Recklinghausen's disease reported by GUIST (62, **Recklinghausen's disease with involvement of the lids and bulbar conjunctiva**) worthy of note. The patient was a woman 45 years old, who had noticed for twenty-one years that isolated wartlike bodies were scattered all over her body, and that these gradually grew larger. Together with these cutaneous fibromata and a partial hypertrophy of the left side of the face, the disease affected the conjunctivæ of both eyes and there was a neurofibroma at the limbus of the right eye.

KIEHLE (63, **Phlegmon of the conjunctiva following operation**) records an unfortunate experience after an operation for pterygium. The site of the wound on the following day was transformed into a slough which rapidly spread about the cornea in spite of vigorous treatment and the eye was lost through corneal ulceration and irido-cyclitis. The eye was enucleated but the infection persisted in the orbit which continued to discharge pus for a number of days. The organisms found were streptococcus and staphylococcus but they were of low pathogenicity for animals. The operation was performed in the hospital and the usual operative technic was employed so that the means through which infection was introduced could not be determined. ALLING.

KUBIK's (64, **Spirochætal conjunctivitis in infants with congenital syphilis**) patient was a baby 7 weeks old, suffering from a severe form of congenital syphilis marked by great emaciation, pemphigus syphiliticus, coryza syphilitica, rhagades at the angles of the mouth and lids, and syphilitic changes in the mucous membrane of the mouth. Although there were no papular or gummatous processes in the conjunctiva, spirochætæ could be obtained from the epithelium of the infiltrated tarsal conjunctiva. As they could regularly be found after a thorough cleansing, it is not probable that they came from the rhagades at the canthus.

CORDS (61, **Treatment of vernal conjunctivitis**) saw an apparently complete objective and subjective cure follow in a few days after an injection of afenil, a solution containing 11.42% chloride of calcium and 68.28% urea. The patient, a woman 21 years old, had suffered for two years from a typical pericorneal vernal conjunctivitis which had proved resistant to any tried form of treatment. Cords then recommends afenil for a wonderful number of diseases, and says that aside from a general feeling of warmth, especially in the mouth, no bad effects have been observed. Its use is contraindicated by heart and arterial disease.

BRAUNSCHWEIG (60, **Formation of folds in the conjunctiva**) has observed the formation of folds in the bulbar conjunctiva of four elderly people. In consequence of a loss of elasticity through atrophy of the elastic fibers, a narrow lip-like fold of the bulbar conjunctiva may be formed at the edge of the lower lid. In three of these cases the fold was removed through the excision of a crescentic piece of conjunctiva on the outer side of the eyeball and the closure of the wound with sutures.

SCHREIBER (66, **Formation of folds of the bulbar conjunctiva**) reports two cases similar to those described by Braunschweig. He excises the fold itself with a crescentic piece of conjunctiva parallel to the margin of the lower lid. In one of his cases this fold formation was associated with a blepharochalasis, and the similarity of the changes was evident.

X.—THE CORNEA AND SCLERA.

67. BANE, W. C. AND BANE, W. M. **Disciform keratitis.** *American Journal of Ophthalmology*, November, 1921.

68. BEHMANN. **Two cases of band-like opacities of the cornea in seeing eyes of young patients.** *Klin. Monatsbl. f. Augenheilk.*, lxvi., p. 450.

69. BIRCH-HIRSCHFELD. **Injuries of the human eye by the X-rays.** *Zeitschrift f. Augenheilkunde*, xlv., p. 199.

70. FREYTAG. **Blue sclera and fragility of the bones.** *Klin. Monatsbl. f. Augenheilkunde, lxvi., p.* 507.

71. GARRAGHAN, E. F. **Papilloma of the cornea.** *American Journal of Ophthalmology*, October, 1921.

72. GRADLE, H. S. **The present status of keratoplasty.** *Ibid.*, December, 1921.

73. KLEIBER. **Keratitis bullosa and scleroticans in sclerodermia.** *Berl. augenärztl. Ges.*, November 25, 1920.

74 KRÄMER. **Episcleritis metastica furunculiformis.** *Klin. Monatsbl. f. Augenheilkunde*, lxvi., p. 441.

75. KÜMMEL. **Peculiar injury of the cornea by the X-rays.** *Ibid.*, lxvi.

76. KUSAMA. **Primary fatty degeneration of the cornea.** *Ibid.*, lxvi., p. 111.

77. LÜSSI. **Thinning of the cornea with and without ectasia.** *Ibid.*, lxvi., p. 905.

78. PICK. **Blinding of an infant by instillation of wrong solution** *Ibid.*, lxvi., p. 485.

79. SCHNYDER. **Studies of the normal and pathological endothelium of the cornea with the Nernst slit lamp.** *Ibid.*, lxvi., p. 785.

80. TENNER, A. S. **The relief of partial or complete anterior staphyloma.** *Journal A. M. A.*, November 26, 1921.

BANE (67, **Disciform keratitis**) relates a typical case of this disease which recovered after three months with a thin central opacity. The various causes which have been suggested are injury, syphilis, small-pox, vaccine virus, tuberculosis (first proposed by Tyson), neuropathic (Verhoeff). None of these seems to apply in this case. The treatment instituted was subconjunctival injections of cinnamat of sodium 2% and 15*m* doses.

ALLING.

The rare picture of band-like opacities of the cornea usually appears in blind eyes and in the stage of degeneration of glaucoma or of chronic iridochoroiditis. BEHMANN(68, **Band-like opacities of the cornea in seeing eyes of young patients**) states that he has seen within a few months such an opacity in two young patients with seeing eyes. Almost exactly the same clinical picture was present in both patients. In both the bilateral opacity was ascribed to an antecedent iridocyclitis with circular posterior synechiæ. Neither patient showed any sign of

tuberculosis or of hereditary syphilis, but the general condition of each was not good, said to be lymphatic asthenic. One patient was treated with atropine and yellow ointment without any visible result, while a double iridectomy in the other, performed for optical purposes, induced a considerable clearing up of the corneal opacity.

KUSAMA (76, **Primary fatty degeneration of the cornea**) observed a case of this nature in a woman 55 years old. He found that the fatty substance consisted mainly of a mixture of cholesterin and fatty acid. Cholesterin is made recognizable in the form of greenish-blue rhombic crystals by the addition of Lugol's solution and sulphuric acid.

BIRCH-HIRSCHFELD (69, **Injuries of the human eye by the X-rays**) has found changes in the vessels of the episcleral tissue, of the iris and retina, and in the epithelium of the cornea. He reports two cases. The first case proves, he claims, that hard, filtered rays can injure the deep layers of the cornea, although this is scarcely to be taken into account when dealing with an intraocular malignant tumor. The second case may be unique in that the application of the rays to an affection of the lid caused blindness and pain in a healthy human eye. The microscopic examination of the eye showed absolute glaucoma with marked changes in the epibulbar and intrabulbar vessels as well as in the cornea. At the limbus the picture closely resembled the epithelial changes seen after frequent irradiations of the conjunctiva with ultraviolet light. The layer of basal cells in the epithelium of the cornea was transformed into flat epithelia with rod shaped nuclei; then came a layer of swollen, blue stained cells of irregular shape, which showed signs of breaking down, while the covering layer consisted of a single layer of flat cells. In other places the corneal epithelium was reduced to a single layer of flat cells. There was an irregular broadening of the layer with conelike proliferation toward the subepithelial tissue of a peculiar, glassy, homogeneous consistence; plasma cells in the subepithelial tissue, vessels narrowed in places, dilated in other places, and frequently recognizable detachment of the intima. A newly formed jellylike granulation tissue extended like a pannus over the margin of the cornea with numerous dilated vessels; finally there was a dense infiltration of the deeper layers of the cornea.

KÜMMEL (75, **Peculiar injury of the cornea by the X-rays**) observed a reduction of the sensitiveness of the cornea after exposure to the X-rays. Whether there was a reduction of the power of resistance of the tissue in addition to the nervous disturbance, was not determined.

GARRAGHAN (71, **Papilloma of the cornea**) describes a large, pinkish, granular tumor which sprang from a pedicle attached to the sclero-corneal junction and covered about four-fifths of the cornea. It had geen growing for about a yeąr. It was excised and the base cauterized but there were a number of recurrences which required repeated cauterization. It was composed of epithelia and connective tissue. When last seen it had almost disappeared but the recurrences would suggest malignancy.

ALLING.

PICK (78, **Blinding of an infant by instillation of a wrong solution**) observed a case in which the conjunctivæ and corneæ of an infant had been badly burned, with subsequent perforation of the corneæ, after the usual instillation of drops by a midwife, which were supposed to be a 1% solution of silver nitrate, but were later found to be a 10% solution.

KRÄMER (74, **Episcleritis metastica furunculiformis**) describes under this heading a condition met with in a man 22 years old. The condition appeared in the course of a general staphylomycotic infection. A nodule as large as a hazel nut formed in the episcleral tissue with severe signs of inflammation and with more or less involvement of the sclera. Pus was evacuated which contained great quantities of the staphylococcus pyogenes aureus, the same agent as found in the furuncles elsewhere on the body. Healing took place gradually after the necrotic parts had been thrown off.

FREYTAG (70, **Blue sclera and fragility of the bones**) found eighteen members of one family, covering five generations, of whom eleven had blue scleras and abnormal fragility of the bones and nine were deaf.

LÜSSI (77, **Thinning of the cornea with and without ectasia**) shows that under certain circumstances considerable and extensive thinnings of the cornea need not necessarily be associated with an ectasia, even when the tension of the eye is elevated. He also found that in keratitis disciformis there is a

marked thickening of the cornea, especially backward, in the region of the infiltrate.

SCHNYDER (79, **Studies of the normal and pathological endothelium of the cornea with the Nernst slit lamp**) says that the endothelium has a wavy surface at the periphery of the cornea, which increases with age. In the second decade minute spherical prominences appear on the posterior surface of the cornea, particularly in the periphery. Henle's warts of Descemet's membrane are generally found first in the fourth decade, mainly in the periphery and usually arranged regularly. The endothelial cells are smaller in childhood than in adult life; in old age it loses its sharp cell margins. After parenchymatous keratitis has run its course the posterior layers of the cornea reflect light strongly. Descemet's membrane is often irregular, the endothelium usually sharp, slightly polymorphous. In congenital hydrophthalmos the endothelium is polymorphous and the margins of Descemet's membrane protrude slightly toward the chamber. The condition of the endothelium is an early symptom in acute iritis and iridocyclitis; at the height of the disease the endothelium is nearly amorphous; beneath precipitates an intact coat of endothelium can often be demonstrated. The visibility of the endothelial reflexes is made difficult in old age by the reduction of the transparency of the posterior layers of the cornea. Swelling of the endothelium was found after operations that opened the anterior chamber. In a case of keratitis disciformis the endothelium in the region of the opacity was amorphous. In iridocyclitis the aqueous contains particles varying in size, the larger ones formed by balling together several cells; folds often appear in Descemet's membrane; the pictures usually described as parenchymatous spaces for the most part appertain to the posterior surface of the cornea.

The clinical history of KLEIBER'S (73, **Keratitis bullosa and scleroticans in sclerodermia**) patient is as follows: Man 44 years old; bald for twenty years. At 30 years of age mature cataract right, anterior polar cataract left. Good vision after extraction of right cataract. Attacks of gout in 1913 and 1915, in the interim a successful extraction of the left cataract. In 1915 bullous keratitis of the right eye with dryness of the skin and fragility of the nails; in 1919 the same disease of the left

eye. In August, 1919, complete sclerotic opacity of the right cornea, a year later increase of infiltrates and blebs on the left cornea. Bilateral glaucoma, tension 35*mm*. Wassermann negative. Diagnosis at the skin clinic, sclerodermia without known cause. The cutaneous symptoms analogous to those on the cornea. The condition probably one of angiotrophoneurosis. The early onset of cataract may perhaps have been due to changes in the ciliary arteries.

GRADLE (72, **The present status of keratoplasty**) after describing some of the methods of keratoplasty which have been occasionally successful relates a case in which he cut out a disk at the edge of an opacity so that part of the disk was in the clear cornea, the trephine entering only about one third of the thickness of the cornea. He then dissected up the disk and without removing it from its bed rotated it so that the clear portion was over the pupillary area. The disk remained partly clear but unfortunately he did not cut deeply enough so that some opacity remained below the area of the operation.

ALLING.

TENNER (80, **The relief of partial or complete anterior staphyloma**) has operated upon eighteen cases of partial and complete staphyloma. He first passed sutures through the cornea outside the limits of the staphyloma using perforated gold plates on either side. An incision is then made through the length of the bulging cornea and the sides of the wound excised to the healthy tissue. He has been uniformly successful.

ALLING.

XI.—THE IRIS AND PUPILS.

81. BENEDICT, W. L. **The character of iritis caused by focal infection.** *Transactions of the American Ophthalmological Society*, 1921.

82. DIMITZ, L., AND SCHILDLR, P. **Nystagmus of the pupils.** *Neurol. Zentralbl.*, 1920, No. 17.

83. FUCHS, E. **Retinal pigment cells in the iris stroma.** *Archiv f. Ophthalmologie*, ciii., Nos. 3-4, 1920.

84. WAGNER, R. **Two cases of expulsive hemorrhage.** *Münchener med. Wochenschrift*, 1920, p. 1424.

85. WICK, W. **Bilateral reflex pupillary immobility after trauma to the skull.** *Klin. Monatsbl. f. Augenheilkunde*, lxv., 1920.

BENEDICT (81, **Character of iritis caused by focal infection**) records the results of interesting experiments conducted in the

Laboratory of the Mayo Foundation with the view to determine whether bacteria taken from diseased teeth and tonsils of a patient suffering from iritis could cause the disease when injected into rabbits. He concludes that iritis may be caused by bacteria from focal infection carried by the blood stream. The affinity from iris tissue seems to develop only under certain conditions and may be lost when the organism is grown under different environment as the bacteria in the teeth and tonsils are constantly undergoing changes and may lose their virulence. There are also changes in the resistance of the body so that a constant warfare is going on between the bacteria and the body fluids.

ALLING.

DIMITZ and SCHILDER (82, **Nystagmus of the pupils**) report the following cases. Case 1: Boy 16 years old with epidemic encephalitis. Ptosis, anisocoria, deviation of one eye upward and outward. After some days nystagmus appeared on looking to the left; later weakness of the abducens. The eyes were then convergent and presented rhythmic convergence and rotatory movements inward together with synchronous contractions of the pupils and synchronous twitchings of the orbicularis. Case 2: Pregnant woman 25 years old, whose pregnancy was interrupted because of nephritis and eclampsia. Four days after the operation, on awakening from a stupor, the patient found that she could not open her right eye or move her right side, while her speech was badly affected. She was found to have spasm of the orbicularis, anisocoria of the right eye [Does this mean dilatation of the right pupil? Ed.], inability to look to the left, vertical nystagmus on looking upward, horizontal nystagmus of the right eye on looking to the right, vertical nystagmus of the left eye on looking up, slight choked disk, paresis of the left facial, and hemiparesis of the right side. Later the paralytic symptoms improved, but the nystagmus persisted. Associated with the vertical nystagmus of the left eye on looking up was a synchronous nystagmus of the pupil, while in the right eye there was an unrest of the pupil, but no nystagmus.

FUCHS (83, **Retinal pigment cells in the iris stroma**) describes two varieties of these cells, mesodermal chromatophores and retinal epithelial cells. The latter are round or

many angled, very dark, with the nucleus usually covered by pigment, while the chromatophores are, on the contrary, slender, branched, the pigment usually lighter and the nucleus visible. As a rule they are easily differentiated apart, but sometimes they are similar. The chromatophores may be densely filled with pigment, as in dark eyed men and in negroes, while the retinal pigment cells during their wanderings in the iris may become stretched out and lighter. Cell masses (Klumpenzellen) come from the anterior of the two retinal layers; how long their formation persists in postembryonal life is not known; likewise it is unknown whether they remain permanently in number and position, or whether individual cells disappear and are replaced by new ones. The disappearance might take place through breaking down within the iris, or through escape of the cell from the iris. The latter certainly occurs, and therefore spontaneous movement must be ascribed to the retinal cells, which may follow certain stimulations. Large accumulations of such cells in the healthy iris play a part hitherto unnoticed in the formation of pigment spots, and they may appear in the diseased iris. Formerly Fuchs thought that the chromatophores alone took part in the formation of this sort of nævus of the iris, but now he believes that retinal pigment cells not only often take part, but sometimes exclusively are concerned in the formation of the nævi. There are therefore, according to the kind of cells, mesodermal, retinal, and mixed nævi iridis. The mesodermal are the commoner, the retinal the more uncommon. The mesodermal may be pigmented in varying degrees, but the retinal are always very dark. The migration of retinal cells into the iris may also occur in pathological conditions, slowly in chronic troubles, rapidly in acute, when in consequence of the action of toxines the iris becomes necrotic. Fuchs was formerly of the opinion that the mobilization of the retinal pigment took place with no multiplication of the cells; he now modifies this view and says that exceptionally multiplication takes place.

WAGNER (84, **Two cases of expulsive hemorrhage**) reports a case of expulsive hemorrhage which occurred in a woman 71 years old with high myopia during an attack of coughing three hours after extraction of a mature cataract. His second case was that of a man 60 years old whose left eye was normal,

the right blind for two years from hemorrhage into the vitreous and detachment of the retina. For some days the externally normal eye had been red. During the night sudden pain with perforation and expulsive hemorrhage occurred in the blind eye. A tumorlike mass protruded from the palpebral fissure that resembled a prolapse of iris enveloped in blood. Microscopical examination showed it to be composed of uveal tissue, mainly choroid, and much blood.

WICK (85 **Bilateral reflex pupillary immobility after trauma to the skull**) reports the case of a nineteen-year-old girl who was struck on the head with a hammer. The immediate results were headache and attacks of dizziness. There were no muscular pareses, or other visible disturbances of the eyes. Later twitchings of the face and of the limbs appeared. Wassermann negative. The right pupil was irregular, 2½*mm* in diameter, and did not respond either directly or consensually to light, but did to accommodation. The left pupil was round, 3*mm* in diameter, and responded distinctly but incompletely to light, perfectly to convergence. Excellent vision for far and near, hypermetropia of each eye 1 D. Concentric contraction of the visual field. The diagnosis of traumatic neurosis was made, but hysteria was thought to be absent.

(*To be continued.*)

V.—**The Ophthalmology of General Practice.** By Dr. Malcolm L. Hepburn, London, published by Paul B. Hoeber, New York, 183 pages. Price $4.

Much has been written concerning the relation of the general practitioner to ophthalmology—how much of ophthalmology should he know; what eye diseases, if any, should he treat; should he attempt refraction? Dr. Hepburn's book is the best answer to these questions that we have seen. Clearly the family physician should be able to tell when a serious eye condition exists, and when an ophthalmologist should be called, just as he should be able to tell when the surgeon, the internist, or aurist should be consulted, and he should be able to treat the more simple diseases of the eye. Having been a general practitioner himself, Dr. Hepburn realizes the needs as well as the limitations of the family physician for such special work.

The chapter on the examination of the eye is especially good, and in general the description of the various eye conditions is clear, accurate, and not too technical to be understood by the average physician, and the treatments advised are reliable. Occasionally, however, we feel that Dr. Hepburn implies a greater degree of skill in the average physician than we think he really possesses,—for instance, we believe that pneumococcus ulcer of the cornea is too dangerous a disease to entrust to the average physician, and certainly most physicians should not be encouraged to use the actual cautery in such cases. The removal of an imbedded foreign body requires a greater degree of skill than is possessed by most physicians, if further damage to the cornea is to be avoided. We do not agree with the doctor's statement that glaucoma is

only a symptom, and that increase in the intraocular pressure following worry and the ingestion of alcohol is due to a rise in the general blood pressure at such times. Nevertheless, the book fills a long-felt need as a link between general medicine and ophthalmology, and may be read with profit alike by the physician in general practice and the beginner in ophthalmology.

A. H. T.

VI.—**Ophthalmoscopy, Retinoscopy and Refraction.** By Dr. W. A. Fischer, Chicago (with 248 illustrations including 48 colored plates), published by Dr. W. A. Fischer, 31 North State Street, Chicago, Ill.

This is a very elementary book. It consists of 218 pages, more than 50 of which are taken up with illustrations.

Ophthalmoscopy is taught chiefly by means of a schematic eye, in the back of which are placed pictures representing various fundus conditions. The same schematic eye is used in teaching refraction and retinoscopy. In the sections on ophthalmoscopy and perimetry the subjects presented are treated with extreme brevity—practically no mention being made of ætiology or pathology, and while there are some good features, it savors too much of the quiz-compend-manikin method of teaching, once so popular in the now extinct fourth-rate medical schools. It gives the student a certain familiarity with the names of diseases, but practically no knowledge of pathological conditions. The same may be said of the chapters on retinoscopy and refraction. While some of the methods described are good, the chapter on optics, upon which these subjects must be based, is too elementary to give the student any practical knowledge of these subjects.

The especially objectionable feature of the book, however, is that throughout it gives the impression that the general practitioner may successfully practice ophthalmology with no other equipment than the meager, superficial, inaccurate knowledge that may be obtained from its study. It is a decided step backward at a time when the general tendency is—and ought to be—for higher standards in medical education. It is an appeal to the mentally lazy physician seeking a short cut to ophthalmology. But there is no short cut to ophthal-

mology, and the sooner the prospective ophthalmologist realizes that a working knowledge of this important branch of medicine can only be obtained after a thorough training in anatomy, physiology and pathology, and clinical experience received in a good eye hospital, the better for him and for the public at large.

A. H. T.